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THE LITTORAL AND SEMI-PARASITIC CYCLOPOIDA, THE MONSTRILLOIDA AND NOTODELPHYOIDA

BY

R. B. SEYMOUR SEWELL, C.I.E., Sc.D., F.R.S.
(Lieut.-Colonel, I.M.S. [ret.])

WITH FORTY-ONE TEXT-FIGURES AND ONE CHART

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INTRODUCTION.

In a previous paper (Sewell, 1947*a*) I have dealt with those genera of the Cyclopoida that belong to the Epiplankton, namely *Oithona*, *Oncaea*, *Lubbockia*, *Pachysoma*, *Sapphirina*, *Copilia* and *Corycaeus*; and in the present report I give an account of those families and genera, which in the main are to be found in the littoral and sublittoral zones of the oceans and in which the type of existence is usually referred to as "semi-parasitic." I have also included certain observations on the Notodelphyoidea and Monstrilloidea.

I have taken this opportunity of including in this report a number of observations that I made while acting as Surgeon-Naturalist to the Marine Survey of India in the R.I.M.S. "Investigator." Up to the present time very little work has been carried out on these groups in Indian waters. Schellenberg (1922) has recorded the occurrence of nine species of Notodelphyids from the Gulf of Suez, all of which he regarded as new: Gurney (1927*a* and *c*) in his reports on the Copepoda of the Cambridge Expedition to the Suez Canal, 1924, recorded from that locality 23 species, of which 11 were new; and A. Scott (1909) in his account of the Copepoda obtained by the "Siboga" in the Malay Archipelago, records 22 species, of which 14 were new. The only report that deals with the present Groups in Indian waters is that of Thompson and A. Scott (1903) on the Ceylon Fishery collections, and they record 42 species, of which 25 were new. I give below the list of species dealt with in the present Report: of these there are 44 in all, and 25 appear to be new.

GNATHOSTOMA.

CYCLOPINIDÆ.

Genus PTERINOPSYLLUS Brady.

Pterinopsyllus egregius Giesbrecht.

CYCLOPIDÆ.

Genus EURYTE Philippi.

Euryte robusta Giesbrecht.
E. brevicauda sp. nov.

Genus EURYCYCLOPS nov.

Eurycyclops magna sp. nov.
E. parva sp. nov.

Genus NEOCYCLOPS Gurney.

? *Neocyclops salinarum* Gurney.

Genus HALICYCLOPS Norman.

Halicyclops christianensis (Boeck.).
,, *thermophilus spinifer* Kiefer.

SIPHONOSTOMA.

ASTEROCHERIDÆ.

Genus DERMATOMYZON Claus.

Dermatomyzon nigripes Brady.

Genus ASTEROCHERES Boeck.

Asterocheres manaarensis Thompson and A. Scott.
A. micheli (Gurney).
A. indicus sp. nov.
A. ovalis sp. nov.

Genus ASTEROPONTIUS Thompson and A. Scott.

Asteropontius nicobaricus sp. nov.

ACONTIOPHORIDÆ.

Genus ACONTIOPHORUS Brady.

Acontiophorus maldivensis sp. nov.

DYSPONTIIDÆ.

Genus PTEROPONTIUS Giesbrecht.

Pteropontius quartus sp. nov.

PŒCILOSTOMA.

CLAUSIDIIDÆ.

Genus HEMICYCLOPS Boeck.

Hemicyclops indicus sp. nov.

LICHOMOLGIDÆ.

Subfamily LICHOMOLGINÆ Gurney.

Genus LICHOMOLGUS Thorell.

Lichomolgus anomalus A. Scott.
L. rotundus sp. nov.

Genus MACROCHIRON Brady.

Subgenus *Macrochiron* Brady.

Macrochiron (*Macrochiron*) *hirsutipes* (T. Scott).
M. (*M.*) *longipes* sp. nov.
M. (*M.*) *spinipes* sp. nov.

Subgenus *Paramacrochiron* nov.

Macrochiron (*Paramacrochiron*) *maximus* (Thompson and A. Scott).

Genus KELLERIA Gurney.

Kelleria andamanensis sp. nov.
K. camortensis sp. nov.
K. gurneyi sp. nov.

Genus PSEUDANTHESSIUS Claus.

Pseudanthessius liber (Brady and Robertson).
,, *obscurus* A. Scott.
,, *gracilioides* sp. nov.

Subfamily SABELLIPHILINÆ Gurney.

Genus PREHERRMANNELLA nov.

Preherrmannella adduensis sp. nov.
P. brevicauda sp. nov.
P. nicobarica sp. nov.

Genus ANTHESSIUS Della Valle.

Anthessius brevifurca sp. nov.
A. investigatoris sp. nov.

MONSTRILLOIDA.

Section CYCLOMORPHA.

THESPESIOPSYLLIDÆ.

Genus ORIENTOPSYLLUS nov.

Orientopsyllus investigatoris sp. nov

Section MONSTRILLOIDEA GENUINA.

MONSTRILLIDÆ.

Genus MONSTRILLA Dana.

Monstrilla anglica Lubbock.
M. ? conjunctiva Giesbrecht.
M. helgolandica Claus.
M. investigatoris sp. nov.
M. longipes A. Scott.

Genus CYMBASOMA Thompson.

Cymbasoma nicobarica sp. nov.

Genus *Haemocera* Malaquin.

Hæmocera danæ (Clap.), Malaquin.

NOTODELPHYOIDA.

BOTRYLLOPHILIDÆ.

Genus BOTRYLLOPHILUS Hesse.

Botryllophilus indicus sp. nov.

CYCLOPOIDA.

Section GNATHOSTOMA.

Family CYCLOPINIDÆ.

Kiefer (1927, 1928 and 1929*c*) has subdivided this family into two subfamilies, Cyclopininæ and Pterinopsyllinæ.

Subfamily CYCLOPININÆ.

In this subfamily are included the genera :

Cyclopina Boeck. (*sensu stricto*).
Cyclopinodes Wilson.
Paracyclopina Smirnov.
Cyclopinella Sars.
Cyclopetta Sars.

Wilson (1932, p. 319) subdivides Boeck's original Genus *Cyclopina* into two genera, namely *Cyclopina* Boeck (*sensu stricto*) and *Cyclopinodes* Wilson, the chief distinguishing features being

(1) The presence in *Cyclopinodes* of 20 or more segments in the 1st antenna of the female.

(2) The terminal section of the maxilliped composed of four densely setose segments.

(3) The number of spines on the terminal segment of the exopod of the first four pairs of legs being 3, 4, 4, 3 respectively.

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(4) The presence of two setæ on the 2nd segment of the endopod of the 1st leg.

(5) The presence of 3 recognizable segments in the 5th leg of the female and 4 in the male.

In this new genus, of which he made *Cyclopinodes elegans* (T. Scott) the genotype, Wilson included also *Cyclopinodes longicornis* (Boeck). Schäfer (1936), while not admitting the validity of the new genus *Cyclopinodes*, divides the species of the genus *Cyclopina* (*sensu lato*) into two groups, a *Cyclopinodes* group and a *Cyclopina* group, as follows :

Cyclopinodes group.—Characterized by possessing a 1st antenna of 15–21 segments. The maxilliped (2nd maxilliped) having the terminal segments supplied with numerous setæ. The 2nd segment of the endopod of the 1st leg having one or two setæ. The 5th leg either 3 jointed or if only two jointed then the terminal segment is armed with 5 setæ or spines. In this group he places :

Cyclopina barentsiana Smirnov.
C. belgica Giesbrecht.
C. dilatata Sars.
C. elegans T. Scott.
C. intermedia Sewell.
C. littoralis (Brady).
C. longicornis Boeck.
C. longifurcata T. Scott.

I am, however, very doubtful regarding the advisability of grouping together species in which there is only a single seta on the 2nd segment of the endopod of the 1st leg with others in which there are two setæ in this position. Of the above the following species are all characterized by possessing two setæ in this position.

Cyclopina elegans T. Scott,
C. barentsiana Smirnov,
C. belgica Giesbrecht,
C. longifurcata T. Scott,*
and *C. pusila* Sars.

Cyclopina longifurcata T. Scott must be classed by itself for it differs from nearly all other Copepods in having as many as 26 segments in the 1st antenna ; it also differs from the other members of this group in possessing only two segments in the 5th leg.

Certain other species are known to possess three segments in the 5th leg. According to Sars (1913–18, pl. V) *Cyclopina longicornis* Boeck exhibits this character, but possesses only a single seta on the middle segment of the endopod of the 1st leg. Three other species possess the three-segmented 5th leg, but information is lacking regarding the number of setæ on the middle segment of the endopod of the 1st leg ; it is thus impossible to decide whether these species, namely :

Cyclopina dilatata Sars.
C. intermedia Sewell.
C. littoralis (Brady).

* Kiefer (1929, p. 14) states that *Cyclopina longifurcata* T. Scott possesses only one seta on the inner margin of the 2nd segment of the endopod of the 1st leg, but T. Scott (1901, p. 240, pl. xvii, fig. 12) describes and figures two in this situation.

can be grouped in the same section as *elegans*, *barentsiana*, *belgica* and *pusilla* or must be placed in a separate section.

Throughout the Family Cyclopinidæ there is in different species a steady and progressive reduction in the number of free segments in the 1st antenna ; and in the species mentioned above this reduction appears to have been brought about in two different ways and the starting point in each group seems to be the species *Cyclopina elegans* T. Scott, in which according to Sars there may be 20 or 21 segments or, as is confirmed by Gurney, the number may be reduced to 18.

Calanoid segment	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24–25.
elegans (after Sars)	1	2		3		4		5	6	7	8	9	10		11	12	13	14	15	16	17	18	19	20
? *barentsiana, dilatata*	1	2		3			4	5	6	7			8	9	10	11	12	13	14	15	16	17	18	19
belgica, pusilla	1	2		3			4	5	6	7			8		9		10	11	12	13	14	15	16	17
elegans (after Gurney)	1	2		3				4	5	6	7	8	9			10	11	12	13	14	15	16	17	18
littoralis, longicornis	1	2		3				4	5	6			7	8	9	10	11	12	13	14	15	16	17	18
intermedia	1	2		3				4	5	6			7		8	9			10	11	12	13	14	15

If the above reductions in the segments have been correctly determined, it seems possible that we have here two separate groups in each of which the reduction has been brought about by a different method, for in the upper group the 8th and 9th Calanoid segments are represented by the 5th and 6th free segment, whereas in the lower group it is the 4th and 5th that correspond.

Cyclopina group.—In this group the reduction in the segments of the 1st antenna has proceeded further and many species present only ten free segments. The 2nd segment of the endopod of the 1st leg bears only a single seta. The 5th leg of the female is composed of only two segments and the terminal segment bears only 4 or 3 spines and setæ.

The species that Schäfer places in this group and that are characterized by the possession of 3 spines and 1 seta are *Cyclopina longifurca* Sewell and *C. minuta* Sewell. Most of the species have only two spines and a single seta arising between them ; these are :

Cyclopina agilis Wilson.
C. brachystylis Sars.
C. brevifurca Sars.
C. euacantha Sars.
C. gracilis Claus.
C. kieferi Schäfer.
C. latipes Schäfer.
C. norvegica Boeck.
C. pacifica Smirnov.
C. pygmæa Sars.
C. schneideri T. Scott.
C. steueri Früchtl.

Sars (1913–18, p. 209) remarks that he is disposed to regard *Cyclopina schneideri* T. Scott and his own species *C. brevifurca* as synonyms, Scott's name having priority ; but Smirnov

(1935, p. 210, footnote) does not regard the identity of the two species as having been definitely established.

In this group of species we have an even more marked reduction in the number of segments in the 1st antenna, several species possessing as few as 10 segments only. In the table below I have attempted to indicate the probable manner in which this reduction has been brought about :

Calanoid segment	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24–25.
euacantha	1	2		3			4	5	6		7		8	9	10	11	12	13	14	15	16	17	18	19
belgica	1	2			3		4	5	6		7		8			9		10	11	12	13	14	15	16	17
laurentica	1	2			3		4	5					6							7	8	9	10	11	12
latipes, kieferi	1	2			3		4	5					6								7		8	9	10
minuta	1	2			3			4	5		6		7		8	9	10	11	12	13	14	15	16	17
longifurca	1	2			3			4	5		6		7			8		9	10	11	12	13	14	15
brevifurca	1	2			3			4	5				6						7	8	9	10	11	12
steueri *pygmæa* *vachoni* *brachystylis*	1	2			3			4	5				6								7		8	9	10
schneideri	1	2			3				4		5				6				7	8	9	10	11	12
norvegica *gracilis* *agilis*	1	2			3				4		5					6					7		8	9	10
gracilis (after Gurney)	1	2			3			4			5					6					7		8	9	10

The genus *Cyclopina* (*sensu lato*) is well represented in the Western Pacific region ; *Cyclopina barentsiana* Smirnov, *C. brachystylis* Sars and *C. pacifica* Smirnov have been recorded from the north-western area, *Cyclopina pusilla* Sars from Chatham Island and *Cyclopina gracilis* Claus and *C. steueri* Früchtl. from the region of the Malay Archipelago. In Indian waters the genus is represented by three species, *Cyclopina longifurca* Sewell, *C. intermedia* Sewell and *C. minuta* Sewell, all of which are inhabitants of brackish water ; and *Cyclopina schneideri* T. Scott and *C. gracilis* Claus have been taken in the Suez Canal.

Smirnov (1935, p. 203) created a new genus *Paracyclopina* to accommodate a species *Paracyclopina nana* Smirnov, which was taken in brackish water at the mouth of the Suifan River, near Vladivostock ; and he points out that *Cyclopina intermedia* Sewell and *C. longifurca* Sewell resemble this form in certain characters, such as the separation of the head and 1st thoracic segment and the presence of three spines and one seta on the terminal segment of the 5th leg ; and he suggests that these three species may form a systematic group, which possesses a brackish water habitat, whereas most species of *Cyclopina* occur in the sea though they are littoral in their distribution. A third Indian species, *Cyclopina minuta* Sewell, also resembes *Paracyclopina nana* Smirnov in possessing a brackish water habitat and in having the head and 1st thoracic segment separate, and in both species the 1st antenna is composed of 17 free segments, but in *Cyclopina minuta* Sewell the 4th leg possesses only two marginal spines, instead of three, on the outer margin of the terminal segment of the exopod.

The various species of the genus *Cyclopina* (*sensu lato*) can also be grouped according to the number of spines on the terminal segments of the exopods of the swimming legs.

Species.	No. of spines and setæ on exopod 3 of the swimming legs.							
	I.		II.		III.		IV.	
	Sp.	Se.	Sp.	Se.	Sp.	Se.	Sp.	Se.
Cyclopina agilis Wilson	IV	4	V	3	V	3	III	4
Paracyalopina nana Smirnov	IV	—	IV	—	IV	—	IV	—
Cyclopina longifurcata T. Scott	IV	4	—	—	—	—	IV	5
Cyclopina barentsiana Smirnov *C. intermedia* Sewell *C. euacantha* Sars *C. bravifurca* Sars *C. kieferi* Schäfer *C. latipes* Schäfer *C. laurentica* Nicholls *C. minuta* Sewell *C. norvegica* Boeck *C. pacifica* Smirnov *C. pygmaea* Sars *C. vachoni* Nicholls *Cyclopinella tumidula* Sars *Cyclopetta dificilis* Sars	IV	4	IV	5	IV	5	III	5
Cyclopina elegans T. Scott *C. belgica* Giesbr. *C. pusilla* Sars *C. kieferi* Schäfer (exceptionally)	III	5	IV	5	IV	5	III	5
C. longicornis Boeck	III	5	—	—	IV	5	(II + 1)	5

Subfamily Pterinopsyllinæ.

Genus *Pterinopsyllus* Brady.

Pterinopsyllus, Giesbrecht, 1900, p. 46 ; Kiefer, 1929, p. 19.

Up to the present time I have been unable to find any previous record of the occurrence of this genus in the Indian Ocean.

Pterinopsyllus egregius Giesbrecht. (Text-fig. 1, A–H.)

Pterinopsyllus egregius, Giesbrecht, 1900, p. 51, pl. ii, figs. 1–4, 6–10, 12, 15, and 19 ; Kiefer, 1929, p. 20.

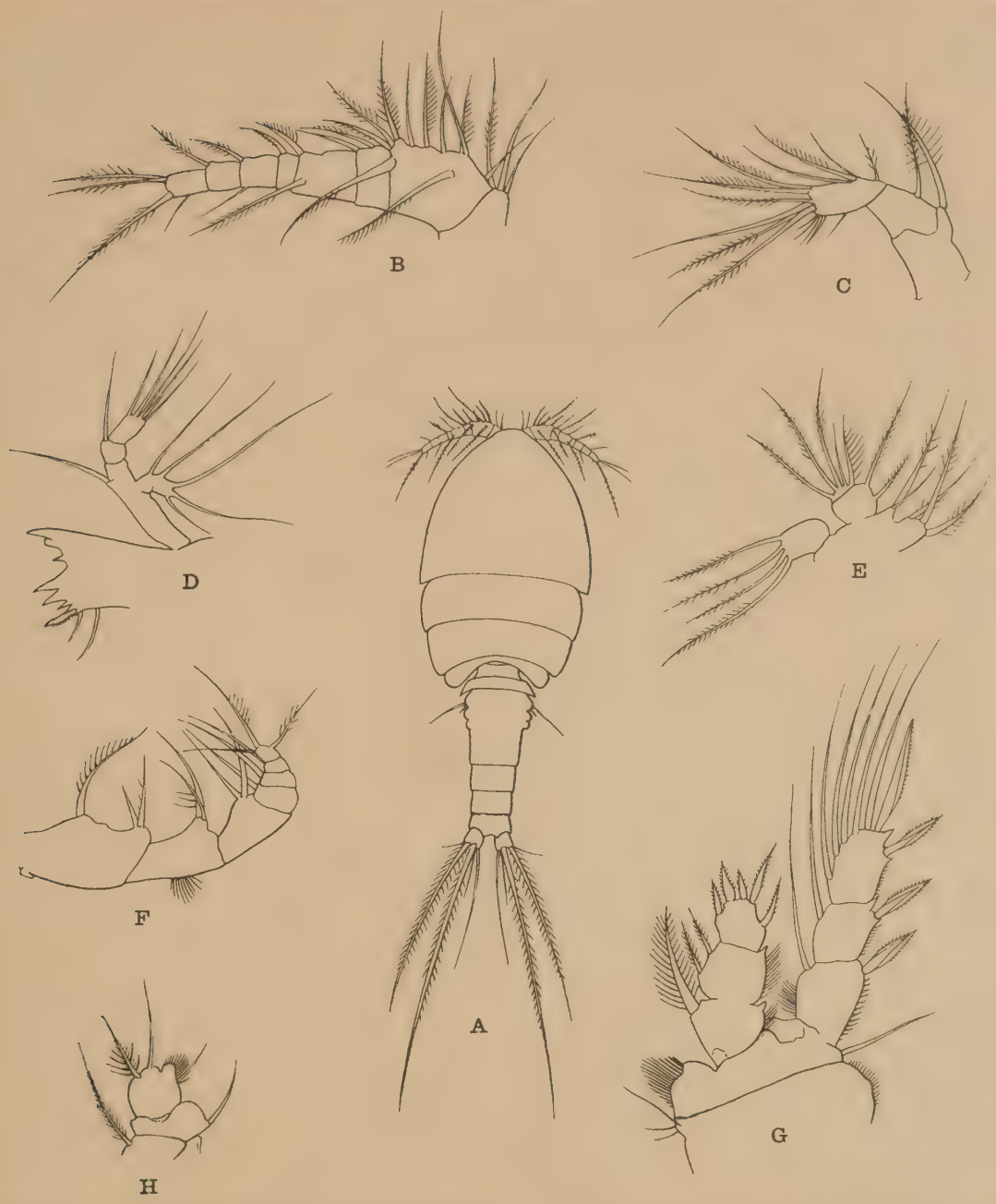
Occurrence.—In weed-washings, Addu Atoll, Maldive Archipelago, 1 specimen, female.

Descriptive Notes.—♀. Total length 0·7 mm.

The specimen is thus slightly smaller than examples from the Gulf of Naples, which measured 1·0 mm.

The head and 1st thoracic segment are fused and the forehead is slightly produced and is rounded, but not so markedly as in *P. insignis* Brady. The posterior region of the body, consisting of the 5th thoracic and the abdominal segments, has the following proportional lengths :

Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
7	45	15	15	10	8 = 100



TEXT-FIG. 1.—*Pterinopsyllus egregius* Giesbrecht, ♀. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, Mandible. E, 1st maxilla, palp. F, Maxilliped. G, 4th swimming leg. H, 5th leg.

The abdominal segments appear to be rather more slender than in the example figured by Giesbrecht. The furcal rami are as broad as long.

The 1st antenna (Text-fig. 1, B) is composed of eight segments, that have the following proportional lengths :

Segment 1.	2.	3.	4.	5.	6.	7.	8.	
132	245	76	189	38	94	94	132	= 1000.

The mouth-parts agree with the description of those in *P. egregius*. The swimming legs, with the exception of the 4th pair, are similar to those of *P. insignis* ; but in the 4th pair (Text-fig. 1, G) the 2nd segment of the endopod bears two short setae on the inner margin and the terminal segment carries 5 spines, of which the central distal one is the shortest.

There seems to be little doubt that this example belongs to the species described by Giesbrecht under the above name from the Gulf of Naples.

Distribution.—The Gulf of Naples (Giesbrecht) and the Maldive Archipelago, (present record).

Family Cyclopidæ.

Kiefer (1927, p. 302) has divided the family Cyclopidæ into the subfamilies Halicyclopinæ, in which he placed the two genera *Euryte* and *Halicyclops*, Eucyclopinæ and Cyclopinæ, and in 1929*c* he included in the Halicyclopinæ the new genus *Neocyclops*, that was created by Gurney in 1927. Gurney (1933, pp. 8 and 17) has, however, expressed doubt regarding the homogeneity of the Halicyclopinæ and he does not accept the view that *Euryte* and *Halicyclops* should be associated together, although he himself described *Neocyclops*, that in some respects is intermediate between the other two : he prefers to regard *Euryte* and *Halicyclops* as forming subgroups, independent of the genus *Cyclops* (*sensu lato*) but within the limits of the family Cyclopidæ. All three of the above genera are represented in the present collection and in addition there are two new species that differ from any of the above and for these I propose the creation of new genus *Eurycyclops*, that is intermediate between *Euryte* and *Neocyclops*.

Mrazek (1893, p. 293) has pointed out that the 17-jointed antennule of *Cyclops* can be derived from the 21-jointed antennule, such as one finds in *Euryte*, and Giesbrecht (1899, p. 130 *et seq.*) has correlated the segments of the antennules in numerous genera of the Cyclopoida with the 25-segmented antennule of the Calanoida. In both the Cyclopinidæ and the Cyclopidæ there occurs a progressive reduction in the number of free joints that are present in the antennule ; but a study of the various species seems to indicate that this reduction has been accomplished in different ways in the two families. I have already (*vide supra*, p. 23) indicated the manner in which this reduction, commencing with the antennule of *Cyclopina euacantha* Sars, in which there are 19 segments and ending with that of *norvegica* Boeck in which there are only 10, has been accomplished in the Cyclopinidæ. In the family Cyclopidæ it seems probable that the methods by which this reduction has been carried out are again different in the subfamilies Halicyclopinæ and Eucyclopinæ and the correct position of the genus *Halicyclops* might be indicated if we can reach a definite conclusion as to the manner in which the segments of the antennule have become fused together to form the six free joints, which is all that the genus possesses.

If we assume, as I think may justifiably be done, that Giesbrecht is right in correlating the various joints of the antennule in the Cyclopoida with the 25 free joints in the Calanoid antennule, and adopting for the moment Kiefer's classification, the different methods of reduction in the family Cyclopinidæ and the two subfamilies Eucyclopinæ and Halicyclopinæ of the family Cyclopidæ are clearly indicated by the number of the calanoid segments that have apparenty become fused together to form the 8 free joints of the antennule in the genus *Pterinosyllus*, and in *Paracyclops fimbriatus* of the Eucyclopinæ and *Neocyclops*, as is indicated in the table below :

Free joint.	1.	2.	3.	4.	5.	6.	7.	8.
Cyclopinidæ. *Pterinopsyllus* .	1	2–7	8–12	13–18	19–21	22	23	24–25
Cyclopidæ.								
Eucyclopinæ. *P. fimbriatus* .	1–3	4–9	10–12	13–18	19–21	22	23	24–25
Halicyclopinæ. *Neocyclops* .	1–3	4–5	6–9	10–11	12–15	16–18	19–21	22–25

It would thus appear that the important joint between the 18th and 19th calanoid segments that forms the hinge-joint in the grasping antenna of the male, lies between free-joints 4 and 5 in *Pterinopsyllus* and *Cyclops fimbriatus* but between joints 6 and 7 in *Neocyclops*.

Various attempts have been made to determine the number of calanoid or cyclopoid segments that have become fused together to form each of the six free joints of the antennule of *Halicyclops* ; Claus (1893), Burckhardt (1913) and Gurney (1933) have all attempted to correlate the *Halicyclops* antennule with that of *Cyclops*, and Gurney (1933) has also attempted to do so with that of *Euryte* : their conclusions are indicated in the table below :

Calanoid segment . .	1–3.	4–5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24–25.
Euryte . . .	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Cyclops . . .	1	2	3		4		5		6		7	8	9	10	11	12	13	14	15	16	17
Halicyclops (Claus) .	1		2						3				4				5			6	
(Gurney) . .	1		2					3					4				5			6	
(Burckhardt) . .	1		2					3					4						5	6	

If now we attempt to trace the intermediate steps by which reduction has been brought about from an antennule of 17 segments, such as is frequently met with in the Eucyclopinæ, we can pass from one species to another, each with fewer segments, till we get to *Paracylops fimbriatus* (Fischer), in which there are only eight, and so to *Halicyclops*, with only six. The stages of reduction in the Cyclopidæ have been indicated by Schmeil (1892, p. 19), and Claus (1893), and I have combined their suggestions into a single table, as below :

Segment . .	1–3.	4–5.	6.	7–9.	10–11.	12.	13–14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24–25.
Cyclops . . .	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
C. insignis Claus .	1	2	3	4	5	6	7		8			9	10	11	12	13	14
C. serrulatus (Fischer)	1	2	3	4	5	6	7		8				9		10	11	12
C. phaleratus (Koch)	1	2		3	4	5			6				7		8	9	10
C. fimbriatus (Fischer)	1		2		3				4				5		6	7	8
Halicyclops (Gurney)	1		2		3				4				5			6	
(Burckhardt)	1		2		3				4						5	6	

Burckhardt's chief arguments in favour of such a method of reduction are based on the number of setae arising from the various segments of the antennule in *Cyclops* and in *Halicyclops* and on the position of the æsthetasc on the antennule of *Halicyclops*, namely on segment 4, which he claims is homologous with the aesthetasc arising from segment 12 in the *Cyclops* antennule. Gurney also uses this æsthetasc as an argument in support of his view, but he concludes that segment 4 of *Halicyclops* only extends to segment 12 of the cyclopoid or 19 of the calanoid antennule, while segment 5 corresponds to

cyclopoid 13–14 or calanoid 20–21, and segment 6 to the last three segments of either form. Certainly the position of the æsthetasc at the extreme distal end of segment 4 of *Halicyclops*, if this be truly homologous with the æsthetasc on segment 12 of the cyclopoid antennule, suggests that this end portion of the segment corresponds with segment 12 of the cyclopoid antennule; but both Gurney's and Burckhardt's suggestions necessitate the conclusion that the important joint between segment 18 and 19 in the calanoid and segment 11 and 12 in the cyclopoid antennule, which we know forms the hinge-joint in the grasping antennule of the male, has become suppressed in the female.

In his attempt to derive the antennule of *Halicyclops* from that of *Euryte*, by passing through the condition found in the genus *Cyclopina*, Gurney (1933, p. 20) arrives at a somewhat different conclusion, as indicated below:

Segment	1–3.	4–5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24–25.
Euryte	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Cyclopina littoralis (Brady)	1	2	3		4	5		6		7	8	9	10	11	12	13	14	15	16	17	18
C. gracilis Claus	1	2	3		4	5				6							7		8	9	10
Halicyclops	1		2			3				4							5		6		

This result differs from the one previously mentioned in that segment 2 of *Halicyclops* is here given as corresponding to calanoid segments 4–8 instead of 4–9, while segment 3 corresponds to calanoid segments 9 to 12 instead of 10 to 12. As in the previous attempt, it must be assumed here also that the joint between segments 18 and 19 of the calanoid antennule and segments 11 and 12 of the cyclopoid antennule has become suppressed. One great objection to attempting to derive the *Halicyclops* antennule from that of *Euryte* by passing through the stages found in certain species of the genus *Cyclopina* lies in the fact that *Cyclopina* belongs to a different Family, in which, as we have already seen, the method of reduction is based on a different plan. If *Halicyclops* belongs to the subfamily Halicyclopinæ and is related to *Euryte*, the method of reduction in the number of segments should be traceable through the other genera of the subfamily, namely *Eurycyclops* gen. nov., and *Neocyclops* Gurney.

Gurney (1933, p. 23, figs. 1238–1240) has shown that the nauplius larva of *Halicyclops*, like all other nauplii, possesses three segments in the antennule, and that there is no change in the number of segments at the moult from the naupliar stage to Copepodid I; Oberg (1906) has also shown that in certain of the Calanoida and in *Oithona* the three segments of the naupliar antennule are transformed into the nine segments of the 1st Copepodid Stage, thus:

Naupliar antennule.		Copepodid I antennule.
Segment 1	.	Segment 1
,, 2	.	,, 2 and 3
,, 3	.	,, 4 to 9.

Gurney has shown that the same holds good for *Eurytemora* and he concludes that "the terminal part of the male antennule corresponds therefore to the 3rd segment of the nauplius."

The male sex is unfortunately unknown in *Eurycyclops* and the only specimen of a male *Neocyclops* that I have seen was immature and the antennule was unmodified and resembled that of the female. Giesbrecht (1901) states that the grasping antennule of *Euryte* is composed of 16 segments : Gurney (1933, p. 53), however, maintains that " the remarkable fact that 17 segments are always traceable in the male antennule of *Cyclops* . . . seems to hold good for *Euryte*," but he reaches this number by supposing that segments 15 and 16 are fused together (*vide* Gurney, 1933, p. 60, fig. 1289). In the genus *Halicyclops* both Canu (1892, p. 184, pl. iii, fig. 8) and Sars (1918, p. 29, pl. xv) give the number of segments in the male antennule as 12 or 11 respectively, but Gurney (1933, p. 22, figs. 1225, 1226) after a careful examination concludes that there are actually 14, though they are very difficult to distinguish. A comparison of the various joints in the antennules of these two genera indicates that they have been derived by fusion of certain calanoid segments in the following manner :

Segment	1–3.	4–5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24–25.
Euryte ♀	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
♂	1	2	3	4	5	6	7	8	9	10	11	12	13	14			15			16	
	3A								A		A		A				A			2A	
Halicyclops ♂	1	2	3		4		5	6	7	8	9	10	11	12			13			14	
	3A				A				A		A		A				A				
♀	1		2				3				4			5			6				
											A										

A indicates the presence of an aesthetasc on that particular segment.

That the above comparison between the segments of the antennule of the male *Euryte* and *Halicyclops* is in all probability a true one is indicated by the positions of the corresponding æsthetascs in the two genera, and it seems justifiable to claim that the æsthetasc on segment 4 of the antennule of the female *Halicyclops* is homologous with that on segment 11 of the male, and with that on segment 13 of the male *Euryte*, and not, as Burckhardt claims, with that on segment 12 of the female *Cyclops*.

In the following table I have given the way by which the reduction in the number of free joints in the female antennule may have been brought about within the genera of the subfamily Halicyclopinæ :

Segment:																					
Calanoid	1–3.	4–5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24–25.
Cyclopoid	1	2	3		4		5		6		7	8	9	10	11	12	13	14	15	16	17
Euryte	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
E. brevicauda (abnormal)	1	2	3	4	5	6	7		8			9	10	11	12	13	14	15	16	17	18
Eurycyclops	1	2	3		4		5		6			7		8			9		10	11	12
Neocyclops	1	2		3			4		5				6				7			8	
													A								
Halicyclops	1		2				3				4			5			6				
											A										

In the genus *Neocyclops* it seems that segments 7 and 8 of *Eurycyclops* have been fused together to form segment 6 and this bears an æsthetasc at about the middle of its length : in *Halicyclops* segments 6 and 7 of *Eurycyclops* have become fused to form segment 4 and

the æsthetasc occurs at the extreme end of the segment ; segment 8 of *Eurycyclops* remains free and corresponds to segment 5 of *Halicyclops* ; finally segments 7 and 8 of *Neocyclops* have become fused to form segment 6 of *Halicyclops*.

In support of his views on the segmentation of the *Halicyclops* antennule Burckhardt (1913, p. 453) has given a table in which he gives the number of setæ arising from the various segments in both *Cyclops* and *Halicyclops*, and Gurney (1933, p. 20) has reproduced this in abbreviated form for the genus *Halicyclops*. That there is a certain degree of correspondence between the numbers of setæ arising from the segments in *Halicyclops* and what Burckhardt believes to be the corresponding segments in *Cyclops* is clear, but a similar or perhaps even closer degree of resemblance can be seen to exist between *Halicyclops* and *Euryte* and in the table below I have given the corresponding series and for reference have included the figures for *Cyclops* as given by Burckhardt and also those given by Hartog (1884), which are slightly different.

Euryte.			*Cyclops.*				*Halicyclops.*	
No. of segment.	No. of setæ (Giesbr.).		No. of segment.	No. of setæ. (Burckdt.).	No. of setæ. (Hartog).		No. of segment.	No. of setæ.
1	8	8	1	8	8	8	1	8
2	3		2	2	4			
3	2		3	2	2			
4	2	11				8 or 12	2	11
5	2		4	4	6			
6	2							
7	2	4	5	2	3	2 or 3	3	3 + 1 sp.
8	2							
9	2		6	1	1			
10	1							
11	1	6	7	2	1	4 or 5	4	6 A
12	1		8	1	1			
13	1		9	1	1			
14	0	1	10	0	1	1	5	2
15	1		11	1	0			
16	1		12	0 A	1 A			
17	0		13	0	0			
18	1	13	14	1	1	13 or 14	6	12
19	2		15	2	2			
20	2		16	3	3			
21	7		17	8	6			

Genus *Euryte* Philippi.

Euryte, Giesbrecht, 1900, p. 52 ; Sars, 1913–18, p. 23 ; Kiefer, 1929, p. 22.

This genus has a wide distribution. Gurney has recorded it from Samoa in the Pacific Ocean ; Thomson obtained examples from New Zealand ; Brady noted its presence off Kerguelen in the Indian Ocean ; Thomson and A. Scott obtained examples in the

Gulf of Manaar; Gurney records its presence in the Suez Canal at Ismailia; T. Scott recorded it from the Antarctic Ocean off the South Orkneys and in lat. 60° 43′ 42″ S., long. 44° 38′ 33″ W.; and in the Altantic Ocean and its offshoot the Mediterranean Sea, it has been taken in a number of widely dispersed areas such as the Black Sea, the Gulf of Naples, the British Isles, the coast of Norway, Greenland and the Arctic Ocean. With such a wide distribution and in view of the few records it is only natural that examples that exhibit small differences should have been described, either as variations of a known species or as new species. The form recorded by Thomson (1883) from New Zealand under the name *E. longicauda* Phil. var. *antarctica* is almost certainly not a variety of that species; Thomson does not give any measurements of the proportional lengths of the furcal rami and abdominal segments, but his figure indicates that the rami are about four times as long as broad, which is much shorter than in *longicauda* Phil. and comes much nearer to *robusta* Giesbr.; he notes that the caudal rami are tinged with dark red, and, according to Sars, they are in *robusta* tinged with deep chestnut. Gurney (1927*b*, p. 459) has suggested that this form is in reality a variety of *E. robusta*. Brady (1910) described *Euryte propinqua* from the Antarctic and in this form the furcal rami, if Brady's illustration is to be relied on, are approximately four times as long as broad: Brady also shows only 20 segments in the 1st antenna, a condition that Sars has noted to occur in *E. robusta*. T. Scott (1912) under the name *E. similis* recorded a form from the South Orkneys and here again the length of the furcal rami is about four times the width. Scott himself states that this form closely resembles *E. robusta* Giesbr., but he adds that it differs in one or two minor points, such as the armature of the 1st and 4th thoracic legs; on comparing Scott's figures with the typical condition in the genus it seems certain that Scott had confused the legs and that what he terms the 2nd leg is in reality the 4th, and his co-called 4th leg is either the 2nd or 3rd. Gurney has suggested that both these forms, *propinqua* Brady and *similis* T. Scott, are in all probability the same species, and both were taken in the Antarctic, and it seems to me that we may go even further than this and regard both forms as slight variations of *Euryte robusta* Giesbr.

If this view be accepted, then it would appear that both *Euryte longicauda* Philippi and *E. robusta*, Giesbrecht have a world-wide distribution, occurring in all three great oceans, and that the latter species has been able to extend its range into the Antarctic, whereas the former has spread northwards into the Arctic Ocean, having been taken in the Arctic seas and off Greenland.

In the present collection the genus is represented by two species, one of which appears to be new.

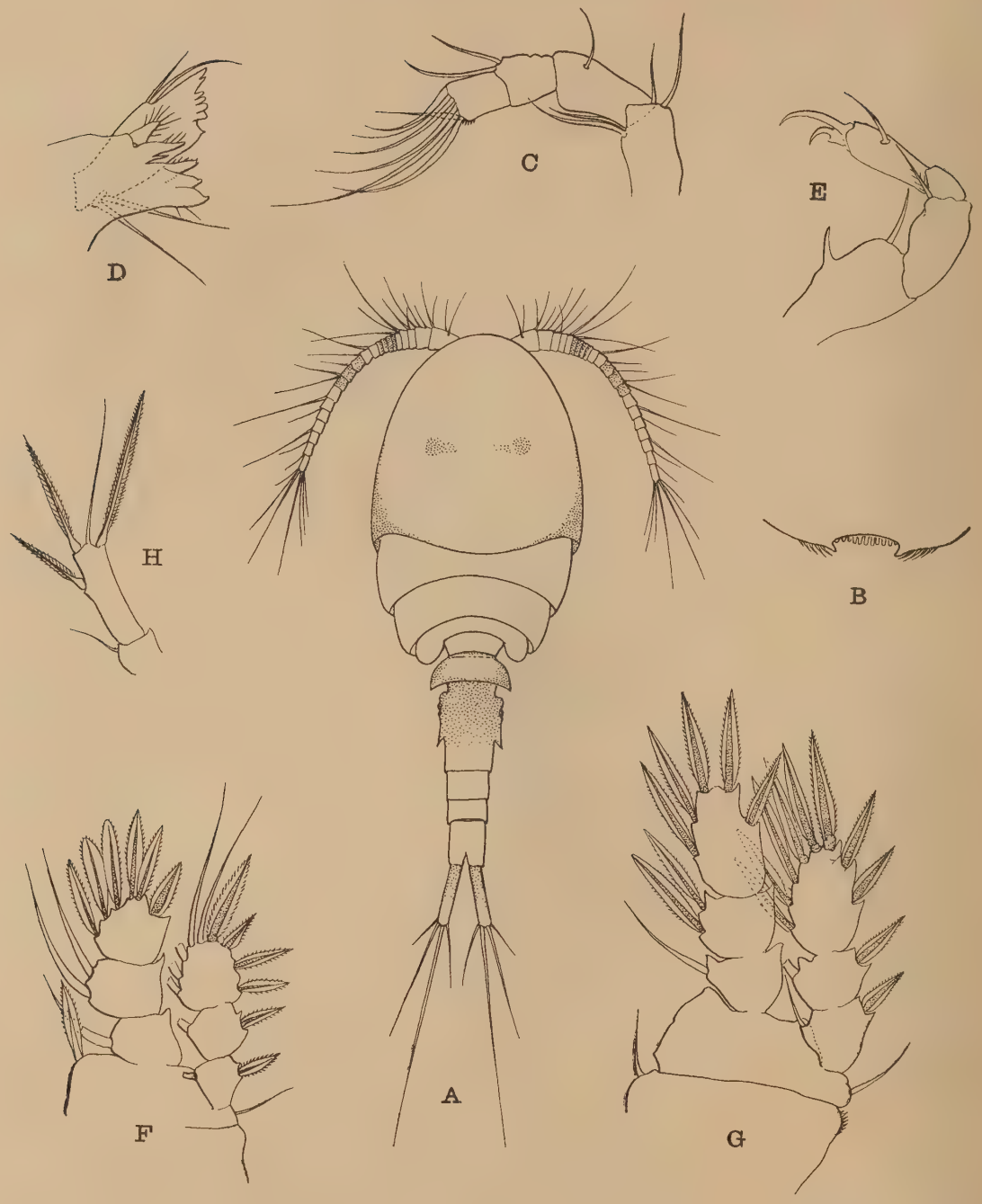
Euryte robusta Giesbrecht.

Euryte robusta, Giesbrecht, 1900, p. 58, pl. iv, figs. 1–14, 16 and 18; Sars, 1918, p. 26, pl. xiii; Kiefer, 1929, p. 23.
? *Thorellia brunnea* var. *antarctica*, Thomson, 1883, p. 95, pl. v, figs. 15–19.
? *Euryte propinqua*, Brady, 1910, p. 566, fig. liii.
? *Euryte similis*, T. Scott, 1912, p. 570, pl. i, figs. 14–22.

Occurrence.—Addu Atoll, Maldive Archipelago; in weed washings.

Descriptive Notes.—♀. Total length 0·79–0·84 mm.

This is considerably smaller than specimens from the Mediterranean Sea or the coast of Norway, which measured 1·10–1·42 mm.



TEXT-FIG. 2.—*Euryte robusta* Giesbrecht, ♀. A, Dorsal aspect. B, Labrum. C, 2nd antenna. D, 1st maxilla. E, Maxilliped. F, 1st swimming leg. G, 4th swimming leg. H, 5th leg.

The proportional lengths of the anterior and posterior regions of the body in the present examples are as 7 to 5 ; Giesbrecht, in his original account, gives them as 8 to 5. The segments of the posterior region have the following proportional lengths :

Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
10	33	11	7	16	23 = 100.

The furcal rami are thus equal in length to the last two abdominal segments : they are a little more than four times as long as wide, and are slightly divergent.

The 1st antenna is composed of 21 segments : Sars (*loc. cit.*, p. 26) states that in his examples this appendage showed only 20 segments, but he has figured 21 in his drawing of the appendage in pl. xiii.

The 2nd antenna, mandible and 1st and 2nd maxillæ agree closely with the descriptions of these appendages given by Giesbrecht and Sars.

The maxilliped seems to resemble that of *Euryte longicauda* more closely than that of *E. robusta* : in the present specimens the terminal claws of this appendage are considerably shorter than in the Norwegian or Mediterranean examples and are more unequal in length.

The setal formula for the swimming legs is as follows :

	Endopod.			Exopod.		
	1.	2.	3.	1.	2.	3.
P1	1	2	VI	1, I	1, I	4–5, IV
P2	1	2	VI	1, I	1, I	IX
P3	1	2	XI	1, I	1, I	IX
P4	1	2	V	1, I	1, I	VIII

In the above, setæ are represented by Arabic and spines by Roman numerals.

The 5th leg appears to be rather more slender and the terminal spines somewhat longer than in the European specimens and thus approximates to the condition in *E. longicauda* Phil.

In its general colouring these examples more nearly resemble *Euryte longicauda* Phil. : the sides of the posterior region of the cephalic segment are stained a brown colour, as also are two triangular areas situated one on either side of the mid-dorsal line about half way along its length. The same brown colour is present over the 5th thoracic segment and the anterior three-quarters of the genital segment, as well as over the greater part of the length of the furcal rami, only the tips of the latter being free from it. Two bands of the same pigment cross the 1st antenna at the 6–9th and the 12–14th segments respectively.

Distribution.—This species has now been recorded from the Maldive Archipelago (present record), Ismailia in the Suez Canal (Gurney), the Gulf of Naples (Giesbrecht) and the coast of Norway (Sars). If I am right in thinking that *E. longicauda* var. *antarctica* Thomson, *E. propinquus* Brady and *E. similis* T. Scott should all be referred to this species the geographical distribution extends to the South-west Pacific and the Antarctic oceans.

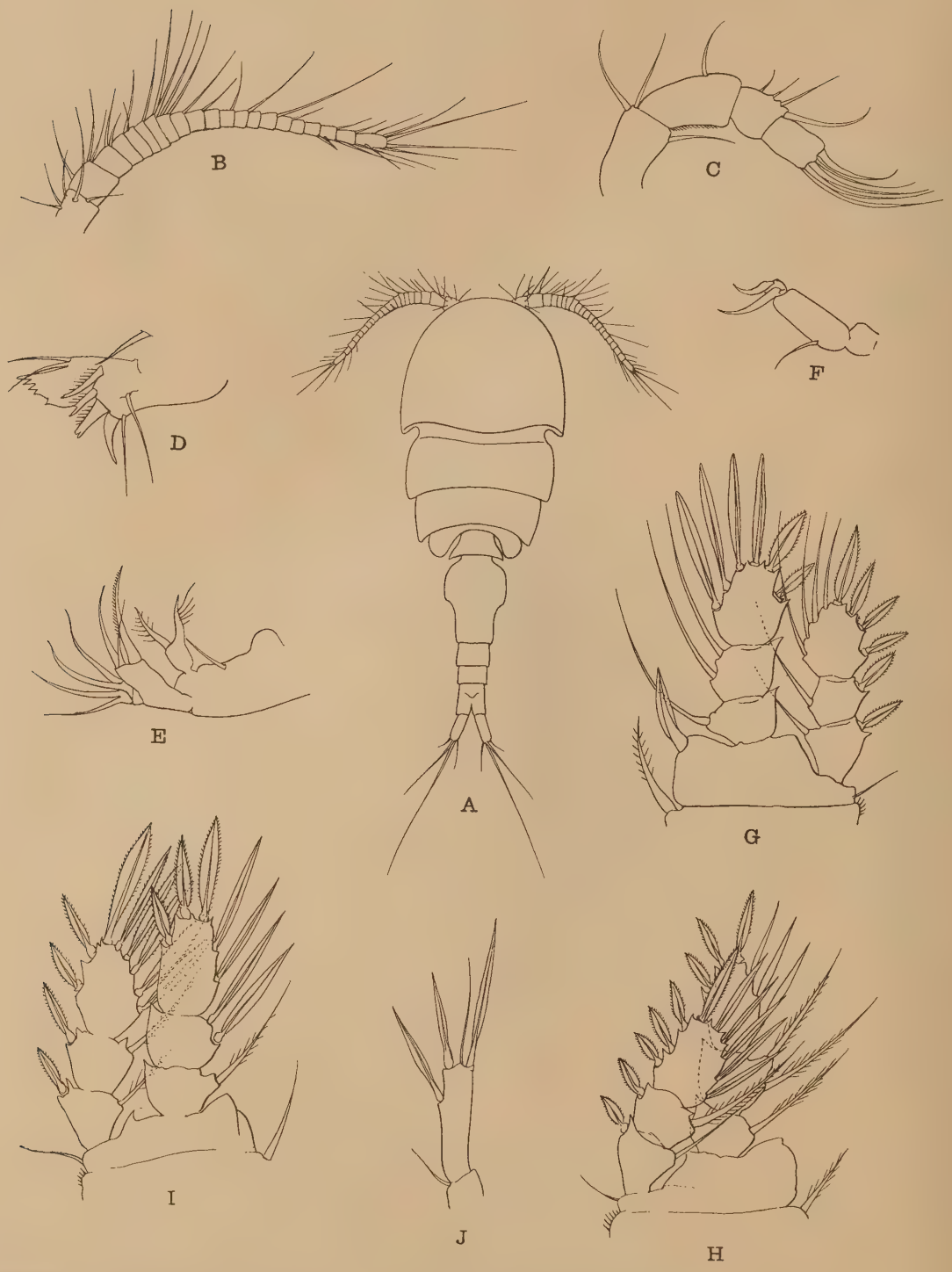
Euryte brevicauda sp. nov. (Text-fig. 3, A–J.)

Occurrence.—Addu Atoll, Maldive Archipelago ; in weed-washings, one female.

Descriptive Notes.—♀. Total length 0·78 mm.

The proportional lengths of the anterior and posterior regions of the body are as 56 to 44. The proportional lengths of the segments of the posterior region are as follows :

Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
12	38	12	11	15	12 = 100



TEXT-FIG. 3.—*Euryte brevicauda* sp. nov., ♀. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, 1st maxilla. E, 2nd maxilla. F, Maxilliped. G, 1st swimming leg. H, 2nd swimming leg. I, 4th swimming leg. J, 5th leg.

The genital segment is swollen in its anterior half. The furcal rami are short, their length being less than that of the anal segment, and only about one and a half times as long as broad. This forms a marked contrast to the condition found in *Euryte longicauda* Phil., in which the rami are equal in length to the last three abdominal segments, and to *E. robusta* Giesb. and *E. curticornis* Sars in which they are about equal to the length of the last two segments.

The 1st antenna (Text-fig. 3, B) consists of twenty-one segments, having the following proportional lengths :

Segment 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.
188	70	47	35	35	23	23	35	35	47	47	35	35	29	35	35	35	47	47	47	70 = 1000

The 2nd antenna (Text-fig. 3, C) and mouth-parts appear to resemble those of other members of the genus.

The swimming legs (Text-fig. 3, G, H, and I) closely resemble those of *Euryte curticornis* Sars, especially as regards the spine-like setæ on the inner margins of the 3rd segments of the two rami, in that they are as long as or even longer than the length of the segment.

The 5th pair of legs (Text-fig. 3, J) resembles those of *Euryte longicauda* Phil., and are much longer and more slender than the corresponding appendage in *E. robusta* Giesb. or *E. curticornis* Sars.

A single specimen that shows great resemblance to the above but differs in certain details of structure was taken in the same locality (Text-fig. 4, A–E.)

♀. Total length 0·75 mm.

The proportional lengths of the anterior and posterior regions are as 57 to 43. The proportional lengths of the segments of the posterior region are similar to those in the previous specimen.

The 1st antenna (Text-fig. 4, B) is composed of only eighteen segments : segments 7 and 8 are partially fused and segments 9, 10 and 11 are completely fused.

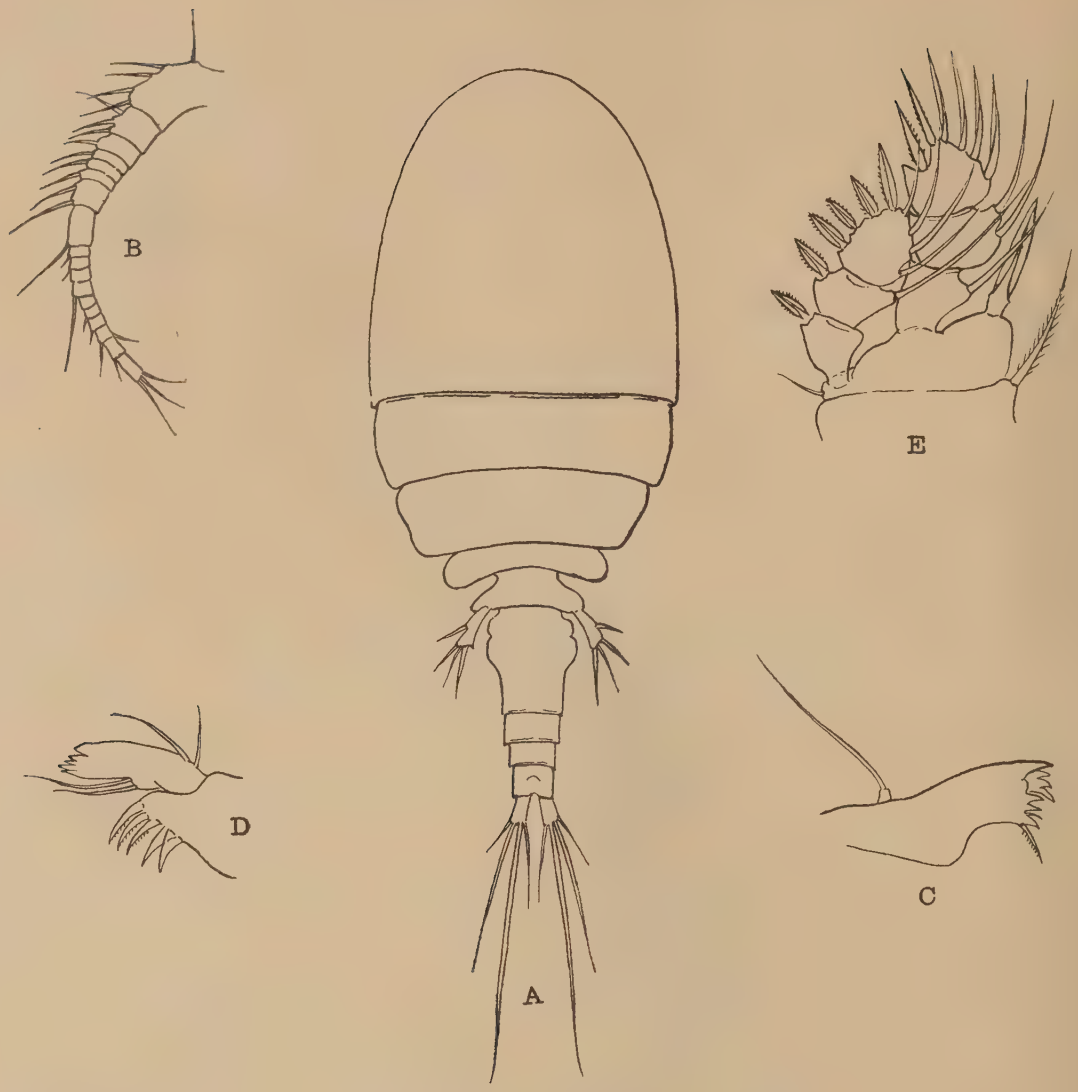
The mandible (Text-fig. 4, C) possesses a biting ramus that exhibits the same characters as that of *Euryte robusta* Giesbr. namely a large anterior tooth, followed by a lobe bearing three teeth that increase in size from before backwards, and then a row of four sharp spine-like teeth : but in this specimen the mandibular palp bears, so far as I could determine, only a single seta, as in the genus *Eurycyclops* gen. nov.

The maxilla (Text-fig. 4, D) shows the same characters as that appendage in *Euryte*.

The 1st leg (Text-fig. 4, E) differs somewhat from that in the previous example in small details, of which the most obvious are the great broadening of the 2nd segment of the endopod and the somewhat larger spine arising from the inner angle of the 2nd basal segment, which in the present specimen reaches as far as the distal margin of the 2nd segment of the endopod, whereas in *E. brevicauda* it attains only about half this length.

The 5th leg resembles that of *E. brevicauda*.

Remarks.—As I had only a single specimen, it cannot be determined whether this is merely an aberrant form of *E. brevicauda* or a closely allied but distinct species. If the mandible really possessed only a single seta on the rudimentary palp, this form would provide a connecting link between the genera *Euryte* Phil. and *Eurycyclops* gen. nov.

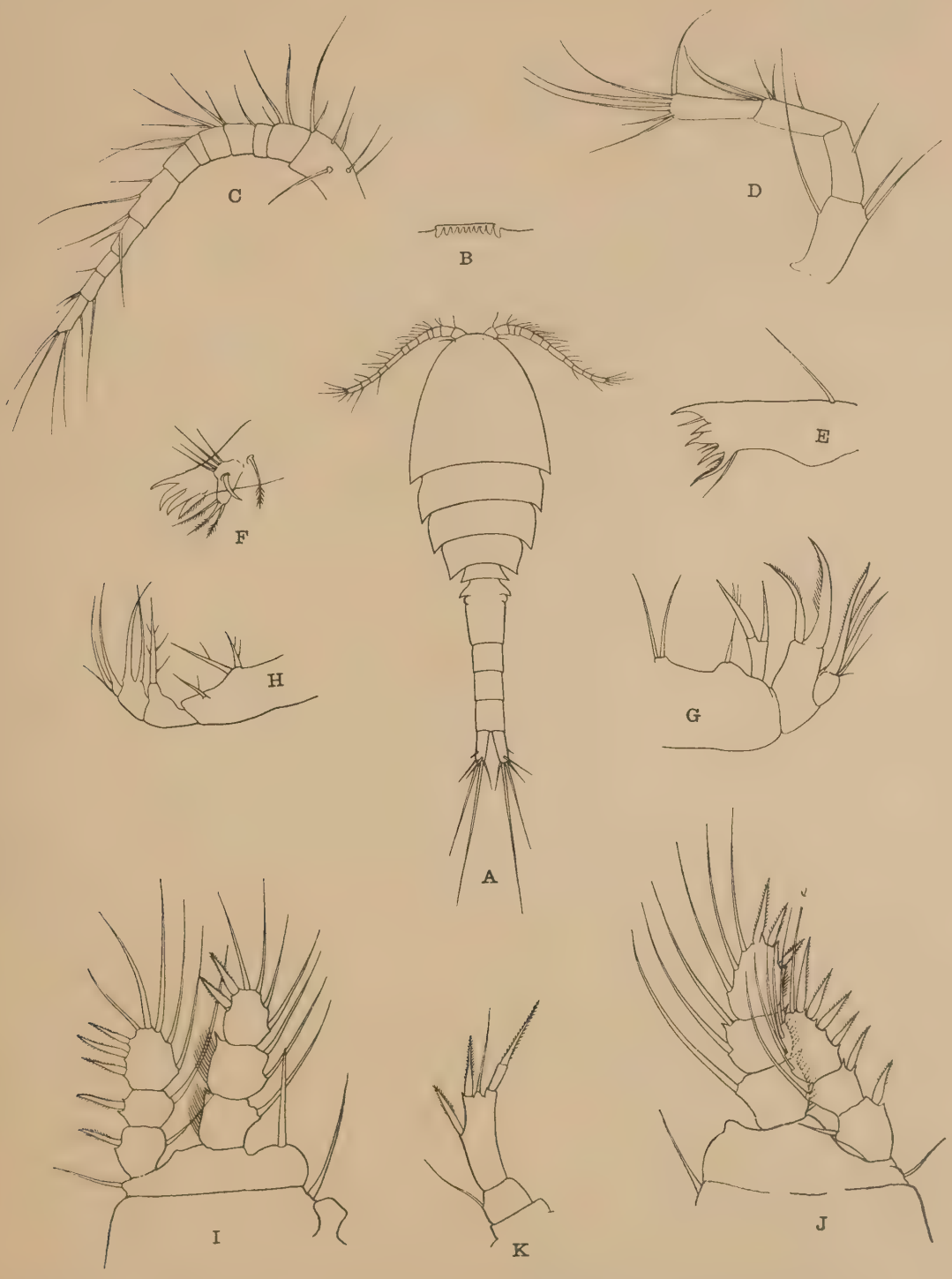


TEXT-FIG. 4.—*Euryte* sp., ♀. A, Dorsal aspect. B, 1st antenna. C, Mandible. D, 1st maxilla. E, 1st swimming leg.

Genus *Eurycyclops* gen. nov.

Among the specimens collected in Addu Atoll in the Maldive Archipelago were a few that do not agree with any previously known species or genus, and it is necessary to create a new genus that is closely related to the genera *Euryte*, *Neocyclops* and *Halicyclops*. For this new genus I propose the name of *Eurycyclops*.

CHARACTERS OF THE GENUS.—The general shape of the body (Text-figs. 5, A, and 6, A) agrees closely with that of other genera of the family Cyclopidæ. The head and 1st thoracic segment are fused. The rostrum is bluntly triangular and depressed. The 1st antenna (Text-figs. 5, C and 6, B) is composed of twelve segments, thus being intermediate between *Euryte*, with 20–21 segments, and *Neocyclops*, with 8 segments; the 1st joint is elongate, and, as in other members of the family Cyclopidæ, is formed by the fusion of the



TEXT-FIG. 5.—*Eurycyclops magna* sp. nov., ♀. A, Dorsal aspect. B, Labrum. C, 1st antenna. D, 2nd antenna. E, Mandible. F, 1st maxilla. G, 2nd maxilla. H, Maxilliped. I, 1st swimming leg. J, 2nd swimming leg. K, 5th leg.

first three segments ; in one specimen of the smaller form, which I have named *Eurycyclops minor*, there appeared to be indications of a lack of fusion in certain segments, thus suggesting that there are actually 18 segments that have become fused together as follows :

Segment	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
	1	2	3		4		5	6		7		8		9		10	11	12

The 2nd antenna is composed of four segments of approximately equal length. The labrum (Text-fig. 5, B) has a crenated free margin, the denticulations increasing in size from the middle line outwards. The mandible (Text-fig. 5, E) consists of a well-developed biting ramus, but the exopod is reduced, so far as I could determine, to a single seta, the condition thus being intermediate between that present in the genera *Euryte* and *Halicyclops*, in which there is a minute palp bearing three setæ, and *Neocyclops*, in which the palp is completely absent. The 1st maxilla (Text-figs. 5, F, and 6, D) closely resembles that of *Halicyclops* ; the biting ramus is armed with four stout teeth, and the palp is somewhat reduced and consists of a single segment that bears four fine setæ on the anterior margin and three plumose setæ at the distal end. The 2nd maxilla (Text-figs. 5, G, and 6, E) also closely resembles that of *Halicyclops* and *Neocyclops* ; the basal segment bears two setæ on the proximal lobe and a single seta distally, as in *Halicyclops*, whereas in *Neocyclops* there are two pairs of setæ present ; the digitiform lobe at the distal end of the 2nd segment bears two unequal setæ ; the 2nd segment is produced in a stout lobe that bears two unequal serrated spines ; and the terminal segment bears three spines and two small and unequal setæ. The maxilliped (Text-fig. 5, H) closely resembles that of *Neocyclops* and *Cyclops*, and consists of four segments ; but the arrangement of the setæ appears to be somewhat different ; the basal segment bears two setæ about the middle of its length and a single seta near the distal end, whereas in *Neocyclops* two pairs of setæ are present ; the 2nd segment is somewhat produced and bears a single seta, instead of a pair as in *Neocyclops :* the 3rd segment, as in *Neocyclops*, bears two setæ ; and the small terminal segment bears two curved setæ of approximately equal length and a very small third one. The swimming legs are intermediate in character between those of *Halicyclops* and *Cyclops*. In the 1st leg (Text-figs. 5, I, and 6, F) the 3rd segment of the exopod bears three marginal spines, but the end-spine is replaced by a plumose seta and the endopod bears on the 2nd segment two setæ, instead of a single one, thus resembling *Cyclops* and *Neocyclops* ; but the terminal segment of the endopod bears two spines near the distal outer angle and four setæ on the inner margin, as in *Halicyclops*. The 2nd pair of legs (Text-fig. 5, J) resembles those of *Halicyclops*, the terminal segment of the endopod bearing three spines and three setæ. The 5th pair of legs (Text-figs. 5, K, and 6, H) closely resembles those of *Neocyclops* and *Euryte* : the 1st segment is imperfectly defined and is partially fused with the base ; the 2nd segment is small and bears a single seta ; and the terminal segment is elongate and bears a serrated spine on the outer margin, and a pair of serrated spines separated by a simple seta, on the distal margin.

Not uncommonly in some of these littoral and neritic species, examples fall into two groups, the chief difference between these being one of size : there are usually, however, few structural features that serve to distinguish the one series from the other. T. Scott (1905, p. 143) has recorded the occurrence off the coast of Scotland of two forms of *Euryte*

longicauda Phil. The larger normal form measures 1·2 mm. in total length, while the smaller form, which he termed var. *minor*, was only 0·8 mm. The 5th foot of the latter form is slightly different in shape and armature from the corresponding appendage in the larger form. Sars (1921, p. 106) regards this small form as a distinct species, *Euryte minor* T. Scott, but Kiefer (1929) does not accept this view. While bearing in mind that these forms may be stages in the life-history of the same species, in the present circumstances it seems best to treat them as specifically distinct, and I have therefore distinguished them by the names *Eurycyclops magna* sp. nov. and *E. parva* sp. nov.

Eurycyclops magna sp. nov. (Text-fig. 5, A–K.)

Occurrence.—In weed-washings, Addu Atoll, Maldive Archipelago.

Descriptive Notes.—♀, Total length, 0·96 mm.

The anterior and posterior regions of the body are of nearly equal length, the proportions being 51 to 49. The anterior region is moderately robust and the abdomen tapers slightly to the furca. The lateral regions of the free thoracic segments are angular, and in the 3rd and 4th turn slightly outwards. The 5th thoracic segment is short and the postero-lateral margins are sharply angular. The abdomen consists of the usual four segments, which have, with the 5th thoracic segment, the following proportional lengths :

Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
11	33	15	12	13	16 = 100

The genital segment is produced at its antero-lateral angle in a small curved projection, immediately behind which is a small round swelling ; the posterior two-thirds of the segment is nearly cylindrical, but tapers slightly towards the distal end. The last two segments are nearly equal in length and the furcal rami are a little longer than the anal segment, and diverge slightly.

The 1st antenna (Text-fig. 5, C) reaches back about three-fourths the length of the cephalon and its segments have the following proportional lengths :

Segment 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
212	61	35	61	50	35	71	131	101	56	76	111 = 1000

The mouth-parts and swimming legs have the characters of the genus.*

In the 5th pair of legs (Text-fig. 5, K) the two spines arising from the distal margin are markedly unequal, the inner being nearly twice the length of the outer.

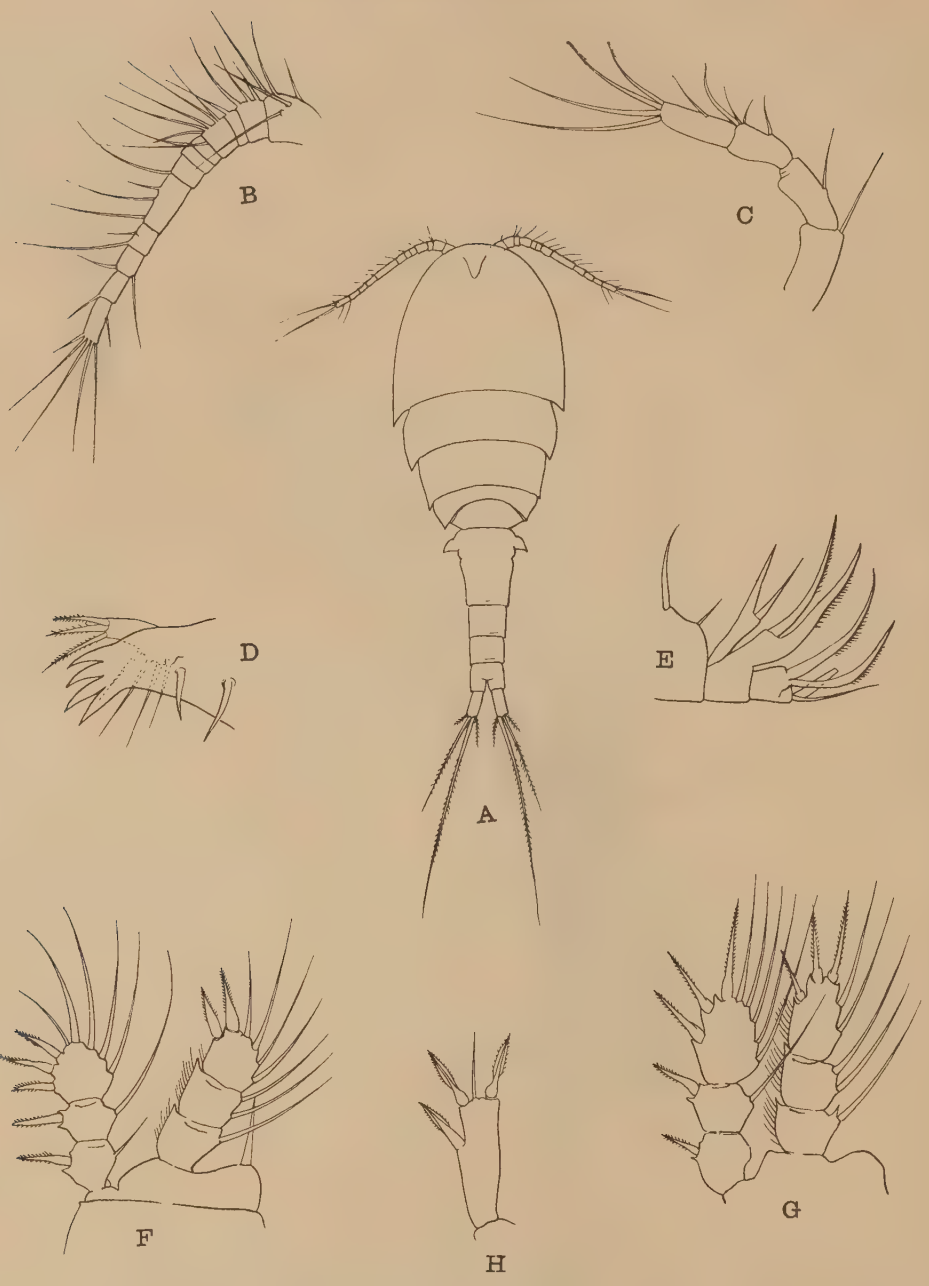
Eurycyclops parva sp. nov. (Text-fig. 6, A–H.)

Occurrence.—Addu Atoll, Maldive Archipelago ; in weed-washings.

Descriptive Notes.—♀. Total length 0·68 mm.

The anterior region of the body (Text-fig. 6, A) appears to be somewhat more robust than in *Eurycyclops magna*. The cephalothorax and abdomen present the same general

* The labrum (Text-fig. 5, B) is armed with a series of ten teeth, of which the outermost are the largest and the rest diminish in succession inwards.



Text-fig. 6.—*Eurycyclops parva* sp. nov., ♀. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, 1st maxilla. E, 2nd maxilla. F, 1st swimming leg. G, 4th swimming leg. H, 5th leg.

features as in the larger form, but the proportional lengths of the segments of the posterior region are somewhat different ; they are as follows :

Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
12	33	14	14	14	13 = 100

The genital segment is produced at its antero-lateral angle in a pointed prominence behind which is a low rounded swelling ; the posterior part of the segment tapers to the distal

end. The three following segments are of equal length. The furcal rami are very slightly shorter than the anal segment; they are about twice as long as broad and are slightly divergent.

The 1st antenna (Text-fig. 6, B) reaches to a little beyond the middle of the cephalic segment: they are composed of twelve segments that have the following proportional lengths:

Segment	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
	176	61	35	70	44	35	70	140	88	70	88	123 = 1000

The 2nd antenna (Text-fig. 6, C) consists of four segments of which the 3rd is slightly shorter than the 2nd and 4th.

The mouth-parts and swimming legs closely resemble those of *Eurycyclops magna*.

The 5th pair (Text-fig. 6, H) of legs has the same general shape as in *E. magna* and, as in that species, bears one serrated spine on the outer margin and two, separated by a seta, on the distal border: the spines are, however, shorter than in *E. magna* and the two distal spines are of equal length.

One of the specimens was ovigerous and carried two ovisacs, each containing 8–10 ova.

Genus *Neocyclops* Gurney.

Neocyclops, Gurney, 1927*b*, p. 460.

This genus was created by Gurney to accommodate a new species that was taken in the Suez Canal at Ismailia. Unfortunately both his description and figures are somewhat inadequate. A single specimen of an immature male that seems to belong to this genus, if not to the same species, *Neocyclops salinarum* Gurney, was taken off the Andaman Islands.

? *Neocyclops salinarum* Gurney, juv. (Text-fig. 7, A–H.)

Halicyclops salinarum, Gurney, 1927*a*, p. 174, figs. 29–32.
Neocyclops salinarum, Gurney, 1927*b*, p. 460, fig. 110, *b–f*.

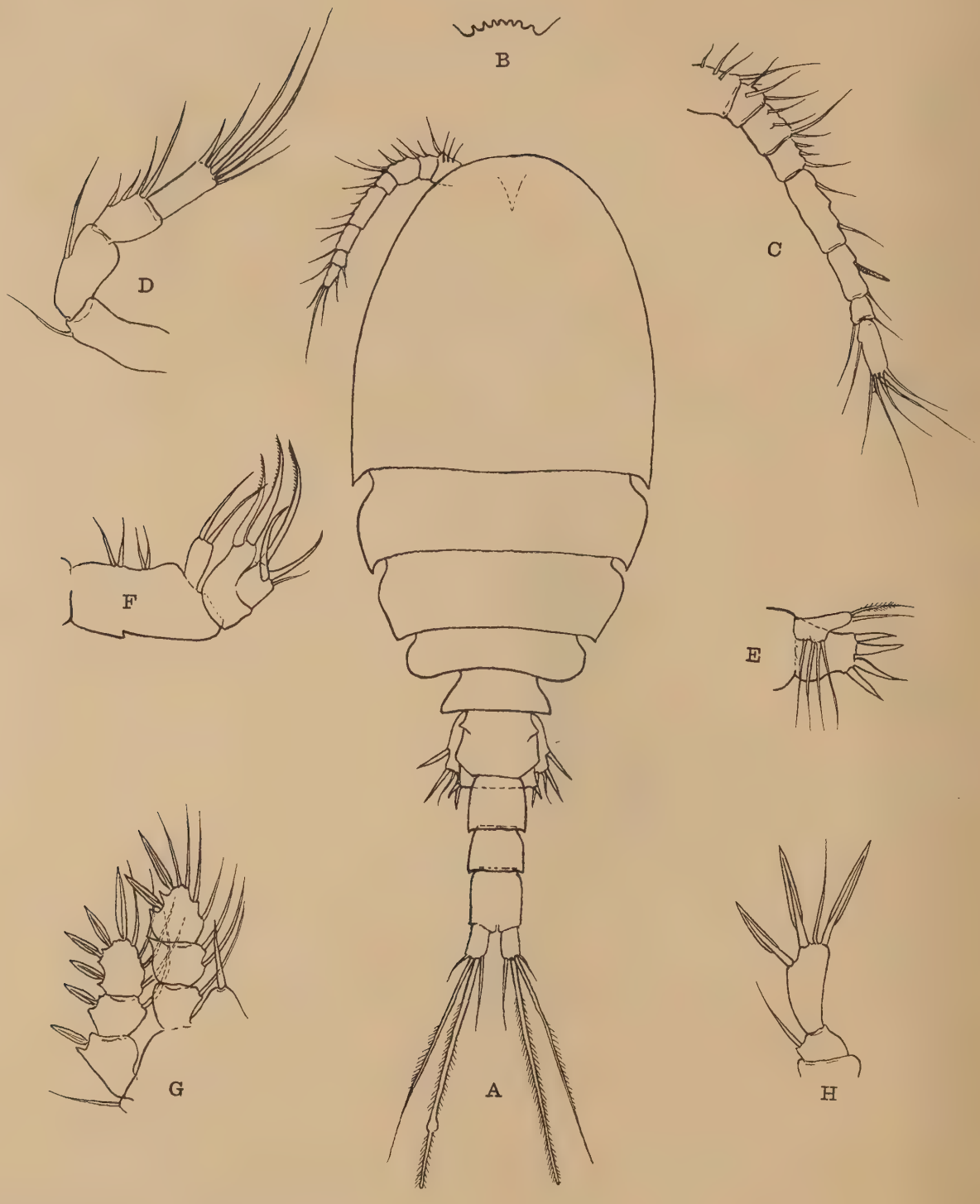
Occurrence.—Andaman Islands, "Investigator" Station 664.

Descriptive Notes.—♂, juv. Total length 0·636 mm.

The anterior region of the body is moderately robust and is widest at the posterior margin of the cephalic segment. The proportional lengths of the anterior and posterior regions are as 67 to 33. The specimen appears to be in the last Copepodid Stage and the abdomen in consequence consists of only four segments and the furcal rami: these have the following proportional lengths:

Th. 5.	Abd. 1.	2.	3.	4–5.	Furca.
10	19	17	15	25	14 = 100

The rostrum is sharply triangular and is depressed. The labrum (Text-fig. 7, B) has a crenated border with eight teeth, the most external being the largest, and the size decreasing to the middle line. The genital segment in its general features recalls the character of the segment in the male of *Euryte robusta* Giesbr. (*vide* Sars, 1918, pl. xiii). It is about



TEXT-FIG. 7.—*Neocyclops salinarum* Gurney, ♂, juv. A, Dorsal aspect. B, Labrum. C. 1st antenna. D, 2nd antenna. E, 1st maxilla. F, 2nd maxilla. G, 1st swimming leg. H, 5th leg.

as broad as long and the posterolateral angle is demarcated off from the rest of the segment and bears two short spines, as in *Pterinopsyllus*, whereas in *Euryte* and *Halicyclops* there is only one. The 4th and 5th abdominal segments have not yet become differentiated. The furcal rami are nearly twice as long as broad ; the 2nd furcal seta is as long as the whole abdomen and the 3rd about two-thirds as long ; the 1st and 4th setæ are quite short.

The 1st antenna (Text fig. 7, C) reaches back to about the middle of the cephalic segment and is composed of eight segments, that have the following proportional lengths :

Segment	1.	2.	3.	4.	5.	6.	7.	8.	
	20	7	11	7	22	15	7	11	= 100
(Gurney)	16	7	12	8	22	16	8	12	= 101

For the purpose of reference I have calculated the measurements of the segments in Gurney's examples of *Neocyclops salinarum* in parts per 100 and have given the result above. It is thus clear that, with the sole exception of a rather longer 1st segment, the lengths of the segments agree closely. As the specimen is immature the 1st antenna is unmodified and resembles that of the female.

In the 2nd antenna (Text fig. 7, D) the separation of the 3rd and 4th segments has not as yet taken place. With this exception the present appendage agrees closely with that of Gurney's examples.

The mouth-parts agree with Gurney's description.

In the 1st swimming leg (Text-fig. 7, G) the 3rd segment of the exopod bears three marginal spines and an end-spine with four normal setæ on the inner margin as in *Euryte ;* but the 2nd segment of the endopod has two setæ on the inner border, as pointed out by Gurney.

The 5th leg (Text-fig. 7, H) has the same form as in *Euryte*, but in this sex the three terminal spines are much longer than in the female and are as long as the distal segment of the appendage.

DISTRIBUTION.—There can be no doubt that this specimen belongs to the genus *Neocyclops*, if not actually to *Neocyclops salinarum* Gurney. Its presence in the Andaman Islands extends the generic range right across the Indian Ocean.

Genus *Halicyclops* Norman.

There appears to be a marked diversity of opinion regarding the number of species that can be recognized in this genus. Sars (1913, p. 28) remarks " in addition to the typical form to be described below, another nearly-allied species has been recorded by the present author from the Chatham Islands as *H. propinquus*, and a 3rd species, not yet described, occurs, as a true planktonic form, in the Caspian Sea." I have been unable to trace any account by Sars of this third species* ; but possibly it is the same as *Halicyclops sarsi* described by Akatova (1935), which is from the Caspian Sea. Burckhardt (1913) recorded examples of a species, which he hesitated to refer to *Halicyclops æquoreus*, from China, and this was later erected into a new species, *H. sinensis*, by Kiefer (1928). In 1924 I described *H. tenuispina* from the Chilka Lake, India, and in the following years

* In 1927 Sars recorded three new species *H. oblongus*, *H. robustus* and *H. pygmæus* from the Caspian Sea but according to Kiefer these must be regarded as " Nomina nuda."

Kiefer described a series of others, namely *H. thermophilus* Kiefer (1929*a* and *b*) from Java, *H. exiguus* Kiefer (1934) *H. similis* and *H. rotundipes* Kiefer (1935), and in the same paper he created two subspecies of *H. thermophilus*, namely *septentrionalis* and *spinifer*, the former from the Baltic and the North Sea and the latter from the estuary of the Ganges in India. Lindberg (1941) described yet another species, *H. canui*, closely related to *H. tenuispina* Sewell, from Bombay. Gurney (1933), while prepared to accept *H. sinensis* and *H. tenuicornis* as valid species, is doubtful regarding the validity of *H. propinquus* and *H. thermophilus*.

In 1936 Kiefer gave a review of the genus and he lists the following as good species :

Halicyclops christianensis (Boeck) (= *H. æquoreus*, Gurney 1933).
H. neglectus Kiefer (= *H. æquoreus propinquus* Gurney).
H. rotundipes Kiefer.
H. propinquus Sars.
H. similis Kiefer.
H. exiguus Kiefer.
H. sinensis Kiefer.
H. tenuispina Sewell.
H. thermophilus Kiefer.
H. t. septentrionalis Kiefer.
H. t. spinifer Kiefer.

It is remarkable that neither in this list nor in his Key to what he terms " Species certæ " does he make any mention of *H. sarsi* Akatova. He also regards the form briefly noted by Thomson (1883) from New Zealand as perhaps synonymous with *Halicyclops propinquus* Sars, but it seems to me that the character of the 5th pair of legs indicates that it is synonymous with *H. exiguus* Kiefer, recorded from Haiti (*cf.* Thomson, 1883, pl. xi, fig. 17, and Kiefer, 1936, fig. 35). I am very doubtful as to the validity of many of these so-called species and am more inclined to regard them for the most part as local variations in a widely distributed species ; but I am prepared to accept *H. christianensis* (= *H. æquoreus* and *H. magniceps*), *H. sinensis* and *H. tenuispina* as valid, as suggested by Gurney.

Halicyclops christianensis (Boeck).

Halicyclops christianensis, Kiefer, 1936, p. 273, figs. 9–14.
Halicyclops æquoreus, Gurney, 1933, p. 18, figs. 1217–1244 ; Sewell, 1934, p. 87.
Halicyclops magniceps, Sars, 1913, p. 29, pl. xv.

In a previous paper I have recorded the occurrence of this form in the Chilka Lake and in the Salt Lakes, Calcutta, near the head of the Bay of Bengal, and further examples, among them ovigerous females, were taken in rock pools at Tuticorin in the extreme south of the Indian Peninsula.

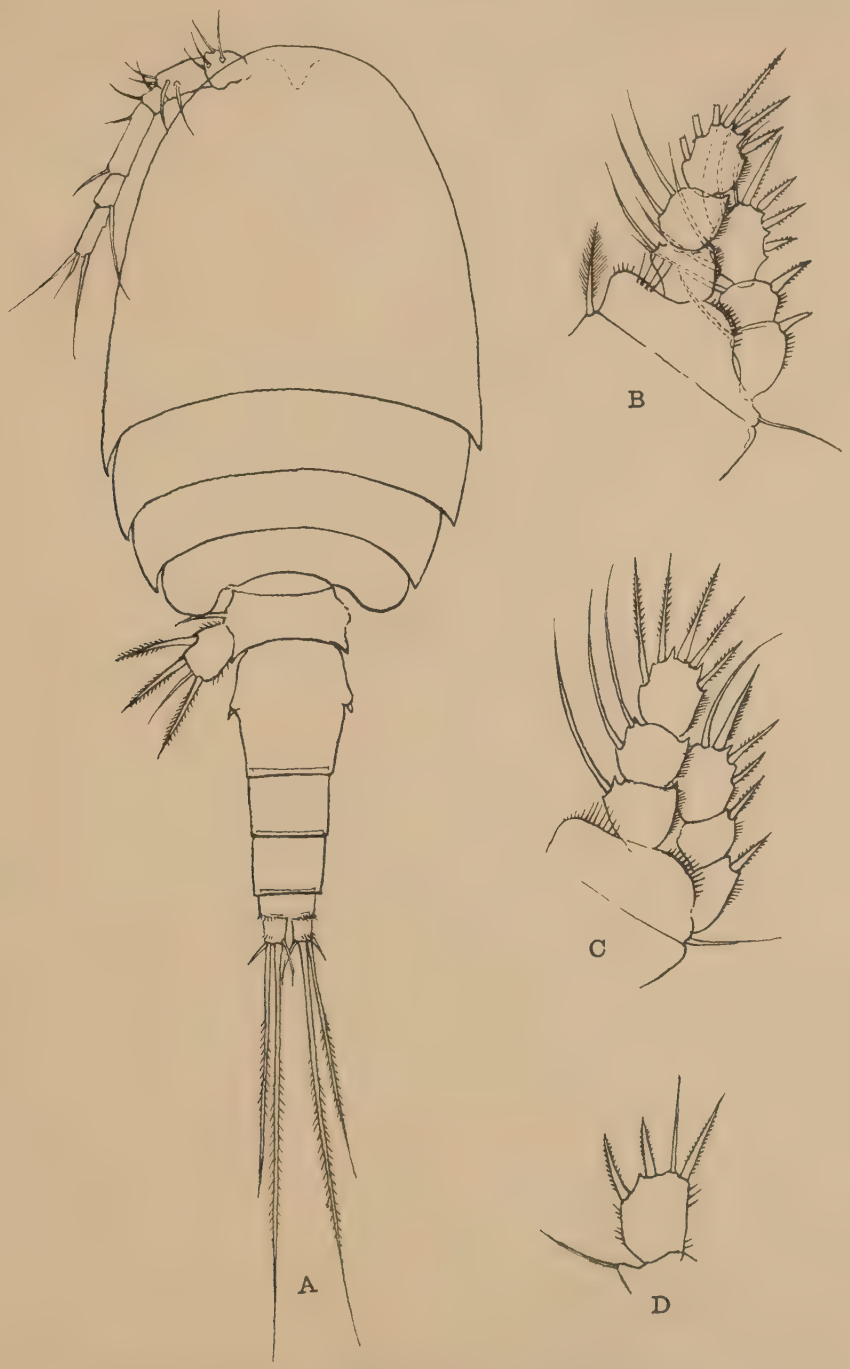
Halicyclops thermophilus spinifer Kiefer. (Text-fig. 8, A–D.)

Halicyclops thermophilus spinifer, Kiefer, 1935, p. 13, fig. 7 ; Kiefer, 1936, p. 285, figs. 47–52 ; Lindberg, 1941, p. 2, fig. 2*a–g*.
Halicyclops propinquus, Sewell, 1934, p. 87.

Occurrence.—In the Chingrighatta Canal, Salt Lakes, Calcutta.

Descriptive Notes.—♀. Total length 0·578 mm.

This agrees very well with Kiefer's examples from Port Canning in the Gangetic Delta, which measured 0·58–0·62 mm., and is slightly smaller than Lindberg's examples from Bombay and Iran, which measured 0·589–0·781 mm.



TEXT-FIG. 8.—*Halicyclops thermophilus spinifer* Kiefer, ♀. A, Dorsal aspect. B, 2nd swimming leg. C, 4th swimming leg. D, 5th leg.

The proportional lengths of the anterior and posterior regions of the body (Text-fig. 8, A) are as 58 to 42. The 1st segment of the anterior region, composed of the cephalon and 1st thoracic segment fused together, is considerably longer than the following four free thoracic segments, the actual measurements being as 55 to 32. The proportional lengths of the segments of the posterior region are as follows :

	Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.	
Present specimen 1 . .	14	36	19	13	10	8	= 100
Halicyclops propinquus (from Burckhardt) .	17	36	19	14	9	5	= 100
Present specimen 2 . .	21	33	15	11	9	11	= 100
Halicyclops sinensis (from Burckhardt) . .	20	34	15	11	9	11	= 100

For convenience of reference I have given above the proportional lengths as given by Burckhardt (1913) for examples of *Halicyclops propinquus* Sars and of the form that he recorded as ? *Halicyclops æquoreus* and which Kiefer named *H. sinensis*. The first of the present examples approximates to *Halicyclops propinquus* Sars, whereas the second very closely resembles the specimens of *H. sinensis* Kiefer from the Yang-tsze-kiang river. Of the long apical furcal setæ the inner measures about half the body length and the outer about one quarter.

The proportional lengths of the six segments of the 1st antenna are as follows :

Segment	1.	2.	3.	4.	5.	6.	
Present specimen .	20	13	9	27	12	19	= 100
H. æquoreus (from Gurney) .	19	17	8	26	11	19	= 100
	(25)	(23)	(11)	(34)	(14)	(25)	

The anterior three pairs of swimming legs closely resemble those of *H. christianensis* (Boeck). In the 4th leg the terminal segment of the endopod bears five spines, as in *H. thermophilus* Kiefer. Lindberg (1941, Text-fig. 2, *e*) shows his specimens as possessing only 3 spines on the last segment of the endopod of the 4th leg, the two inner appendages being normal setæ. Gurney (1933, fig. 1247) has given a figure of an appendage in *H. propinquus* Sars that he states is leg 4, but as he shows three marginal spines on the exopod as well as the end spine, and three spines and three setæ on the terminal segment of the endopod, it seems clear that he has actually figured either leg 2 or leg 3, and has erroneously labelled it leg 4.

The 5th leg in the present specimens is more nearly quadrilateral in its outline than triangular and closely approximate to the shape that occurs in the form that Kiefer (1935, fig. 10) gives for *Halicyclops rotundipes*. Of the three spines the middle one is the shortest and both the middle and outer spines are shorter than the length of the segment that bears them, whereas the inner spine is at least as long as the segment.

Remarks.—It seems probable that the form that I recorded from the Salt Lakes, Calcutta, under the name *H. propinquus* is actually an example of the above so-called species.

SIPHONOSTOMA.

Family Asterocheridæ Giesbrecht, *sens. str.* (= Ascomyzontidæ Sars).

Nicholls, 1944, p. 16.

It seems probable that the various genera that have been included in this family should properly be subdivided into two groups.

I. In the first group the abdomen of the female is composed of four segments.

Throughout the series of genera in this group we get a reduction in the number of segments in the 1st antenna of the female, and this reduction appears to have been brought about by the fusion of certain segments in the following manner :

Segment	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19–20.	21.	22–25.
Australomyzon / *Leptomyzon*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Collocheres	1	2	3	4	5	6	7	8	9		10	11	12	13	14	15	16	17	18	19	20
Rhynchomyzon rubrovit.	1	2	3	4	5	6	7	8	9		10	11	12	13	14	15	16	17	18	19	20
R. purpurocin.	1	2				3	4	5	6			7	8	9	10	11	12	13	14	15	16
R. falco	1	2					3	4	5			6	7		8	9	10	11	12	13	14
Dermatomyzon	1	2	3	4	5		6	7	8		9	10	11	12	13	14	15	16	17	18	19
or	1	2					3		4		5	6	7	8	9	10	11		12	13	14

A sensory filament arises from the distal end of the fused 19–20 segment : throughout the series the terminal portion of the antennule, beyond the segment bearing the sensory filament, is composed of two joints, segments 22–25 being fused into one. In the proximal part of the antennule the 2nd segment may become fused with the 3rd to the 5th or 6th segment.

II. In the second Group the abdomen of the female is composed of only three segments.

In this group also we get a reduction in the number of free segments in the antennule of the female, but the manner in which this reduction has been brought about seems to differ somewhat from that in the first group :

Segment	1.	2.	3.	4.	5.	6.	7.	8.	9–10.	11.	12.	13.	14.	15.	16.	17.	18.	19	20.	21.	22–23.	24	25.
Echinocheres	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
Asterocheres	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
or	1	2	3	4	5	6	7	8	9		10	11	12	13	14	15	16	17	18	19	20		
Mesocheres	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
Asteropontius	1	2	3	4	5	6	7	8	9		10	11	12	13	14	15	16	17	18	19			
or	1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18				
Scottomyzon	1	2		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		19		
Scottocheres	1	2	3	4	5	6	7	8	9		10	11	12	13	14	15	16	17	18				
or	1	2		3	4	5	6	7	8		9	10	11	12	13	14	15	16	17				

In certain species of *Asterocheres* segments 22–25 may be fused together or even segments 21–25.

At the commencement of the series the segmentation is the same as in the first group, but as reduction proceeds, the 2nd segment, with but few exceptions remains separate, and it is the 3rd segment that becomes fused with the 4th : another difference is that the

segments beyond the sensory filament, *i.e.* 21 to 25, may become fused to two and eventually to a single joint.

Giesbrecht (1899, pp. 151–157) has discussed the arrangement of the setæ of the swimming legs and has given (*loc. cit.*, p. 154) a table showing the setal formulæ of many genera. In the formulæ as given in the following pages I have slightly modified the method that he adopted in order to indicate the difference between a seta or a spine, by showing the former in Arabic numerals and the latter in Roman. Throughout the family we get a tendency towards the reduction of the total number of setæ and spines.

The full formula appears to be found in the genus *Australomyzon* in which the numbers present appear to be as follows :

Leg.	Endopod.					Exopod.					
	1.	2.	3.			1.		2.		3.		
	Si.	Si.	Si.	St.	Se.	Si.	Se.	Si.	Se.	Si.	St.	Se.
P1	1	2	6			1	I	1	I	4	1	III
P2	1	2	6			1	I	1	I	5	I	III
P3	1	2	3	I	2	1	I	1	I	5	I	III
P4	1	2	2	I	2	1	I	1	I	5	I	III

In *Echinocheres* and *Asterocheres* the formula follows the same general plan, but there has been a reduction of one inner seta on the 3rd segment of the exopod in legs 1 to 4 inclusive, so that the formula has become

P1	1	2	6			1	I	1	I	3	1	III
P2	1	2	6			1	I	1	I	4	I	III
P3	1	2	3	I	2	1	I	1	I	4	I	III
P4	1	2	2	I	2	1	I	1	I	4	I	III

In *Scottocheres* one seta has been suppressed on the inner margin of the 3rd segment of the exopod of the 4th leg and one on the outer margin of the corresponding segment of the endopod. The formula thus becomes

P4	1	2	2	I	1	1	I	1	I	3	I	III

In *Scottomyzon* one marginal spine has been suppressed on the 3rd segment of the exopod of all four legs and the seta on the outer margin of the 3rd segment of the endopod of the 4th leg has also disappeared : we thus get the formula

P1	1	2	6			1	I	1	I	3	1	II
P2	1	2	6			1	I	1	I	4	I	II
P3	1	2	3	I	2	1	I	1	I	4	I	II
P4	1	2	2	I	0	1	I	1	I	4	I	II

In the other genera of the family the formula differs in that on the 3rd segment of the endopod of the 3rd and 4th legs there is only a single seta external to the terminal spine, although the total number of spines and setæ arising from this segment may be the same as in the previous genera : it thus appears that it is a different seta that has been replaced by a spine. The most complete formula is to be found in *Rhynchomyzon*.

P1	.	1	.	2	.		6		.	1	I	1	I	.	3 or 4	1	III
P2	.	1	.	2	.		6		.	1	I	1	I	.	4	I	III
P3	.	1	.	2	.	4	I	1	.	1	I	1	I	.	5	I	III
P4	.	1	.	2	.	2	I	1	.	1	I	1	I	.	4	I	III

or in *Dermatomyzon*

P1	.	1	.	2	.		6		.	1	I	1	I	.	4	1	III
P2	.	1	.	2	.		6		.	1	I	1	I	.	5	I	III
P3	.	1	.	2	.	3	I	1	.	1	I	1	I	.	4	I	III
P4	.	1	.	2	.	2	I	1	.	1	I	1	I	.	4	I	III

In *Collocheres* we get a reduction from the above of one seta on the inner margin of the 3rd segment of the exopod of the 4th leg :

P4	.	1	.	2	.	2	I	1	1	1	I	1	I	.	3	I	III

In *Leptomyzon* one of the setæ on the last segment of the endopod of the 2nd leg has been converted into a spine and we also get the same reduction of one of the setæ on the last segment of the exopod of the 4th leg, as in *Collocheres ;* the formula thus becomes

P1	.	1	.	2	.		6		.	1	I	1	I	.	3	1	III
P2	.	1	.	2	.	4	I	1	.	1	I	1	I	.	5	I	III
P3	.	1	.	2	.	3	I	1	.	1	I	1	I	.	4	I	III
P4	.	1	.	2	.	2	I	1	.	1	I	1	I	.	3	I	III

In *Mesocheres* the formula, so far as I can ascertain from the published descriptions, is

P1	.	1	.	2	.		6		.	1	I	1	I	.	3	1	III
P2								Not known.									
P3	.	1	.	2	.	3	I	1	.	1	I	1	I	.	4	I	III
P4	.	1	.	2	.	2	I	1	.	1	I	1	I	.	4	I	III

Finally in *Asteropontius* the formula for the 1st leg is

P1	.	1	.	2	.		6		.	1	I	1	I	.	3	1	III or II

and for the 4th leg is

P4	.	1	.	2	.	3	I	1	.	1	I	1	I	.	3	I	III
or	.	1	.	2	.	2	I	1	.	1	I	1	I	.	4	I	III

Genus *Dermatomyzon* Claus.

Dermatomyzon, Claus, 1889, p. 24 ; Giesbrecht, 1899, p. 77 ; Sars, 1916, p. 96.

Dermatomyzon nigripes (Brady and Robertson).

Cyclopicera nigripes, Brady, 1880, p. 54, pl. lxxxix, figs. 1–11.
Dermatomyzon nigripes, Giesbrecht, 1899, p. 7, pl. i, fig. 4 ; pl. v, figs. 1–14 ; Sars, 1913–18, p. 95, pls. lix, lx.

Occurrence.—Addu Atoll, Maldive Archipelago, in weed-washings. A single example of each sex.

Distribution.—Maldive Archipelago (present record), the Mediterranean Sea (Giesbrecht), British Isles (Brady, T. Scott), Coast of Norway and Spitzbergen (Sars), Franz Joseph Land (T. Scott), and the Faröe Islands (Hansen).

Genus *Asterocheres* Boeck.

Asterocheres, Canu, 1892, p. 262 ; Giesbrecht, 1899, p. 67.
Ascomyzon, Sars, 1918, p. 84.

Several species belonging to this genus have been previously recorded from the Indian Ocean or its offshoot the Red Sea. Thompson and A. Scott (1903, p. 287) recorded six species, of which three were then new, from the Gulf of Mannar, namely, *Asterocheres stimulans* Giesbrecht, *A. dentatus* Giesbr., *A. minutus* Claus, *A. manaarensis* Thomp. and A. Scott, *A. major* Thomp. and A. Scott and *A. minor* Thomp. and A. Scott. Gurney (1927, p. 462) has recorded *A. lilljeborgii* Thorell (= *A. siphonatus* Giesbr.) and a new species, *A. micheli*, from the Suez Canal.

In the present collections there are five species belonging to this genus, of which three appear to be new.

Asterocheres manaarensis Thompson and A. Scott.

Asterocheres manaarensis, Thompson and A. Scott, 1903, p. 287, pl. xix, figs. 11–20.

Occurrence.—Addu Atoll, Maldive Archipelago, in weed-washings. One specimen, female.

Descriptive Notes.—♀. Total length 0·82 mm.

This is slightly larger than the Ceylon specimens, which were found in washings from sponges and measured 0·78 mm.

The proportional lengths of the anterior and posterior regions of the body are as 2 : 1. The proportional lengths of the various segments in the posterior region are as follows :

Th. 5.	Abd. 1–3.	4.	5.	Furca.
19	40	19	15	7 = 100

These proportions are very close to those of *A. dentatus*, which Giesbrecht gives as 30, 13, 8, 5, or, when calculated in the same proportions, 43, 19, 11, 7.

The appendages agree with the description given by Thomspon and A. Scott.

These authors do not mention the siphon : in the present specimen it is pyriform and of moderate length.

The coloration of the specimen was a uniform brown.

Distribution.—The Pearl Banks, Gulf of Manaar (Thompson and A. Scott) and the Maldive Archipelago (present record).

? *Asterocheres micheli* (Gurney).

Ascomyzon micheli, Gurney, 1927, p. 462, fig. 110, *g.* and *h.*

Occurrence.—" Investigator " Station 669, Perseus Reef, Camorta Island, Nicobar Islands. One male.

Remarks.—So far as I could determine this single specimen appears to agree closely with the description and figures given by Gurney.

Distribution.—The Nicobar Islands (present record) and the Suez Canal (Gurney).

Asterocheres orientalis sp. nov. (Text-fig. 9, A–J.)

Occurrence.—Addu Atoll, Maldive Archipelago ; in weed-washings. Three females.

Descriptive Notes.—♀. Total length 0·88 mm.

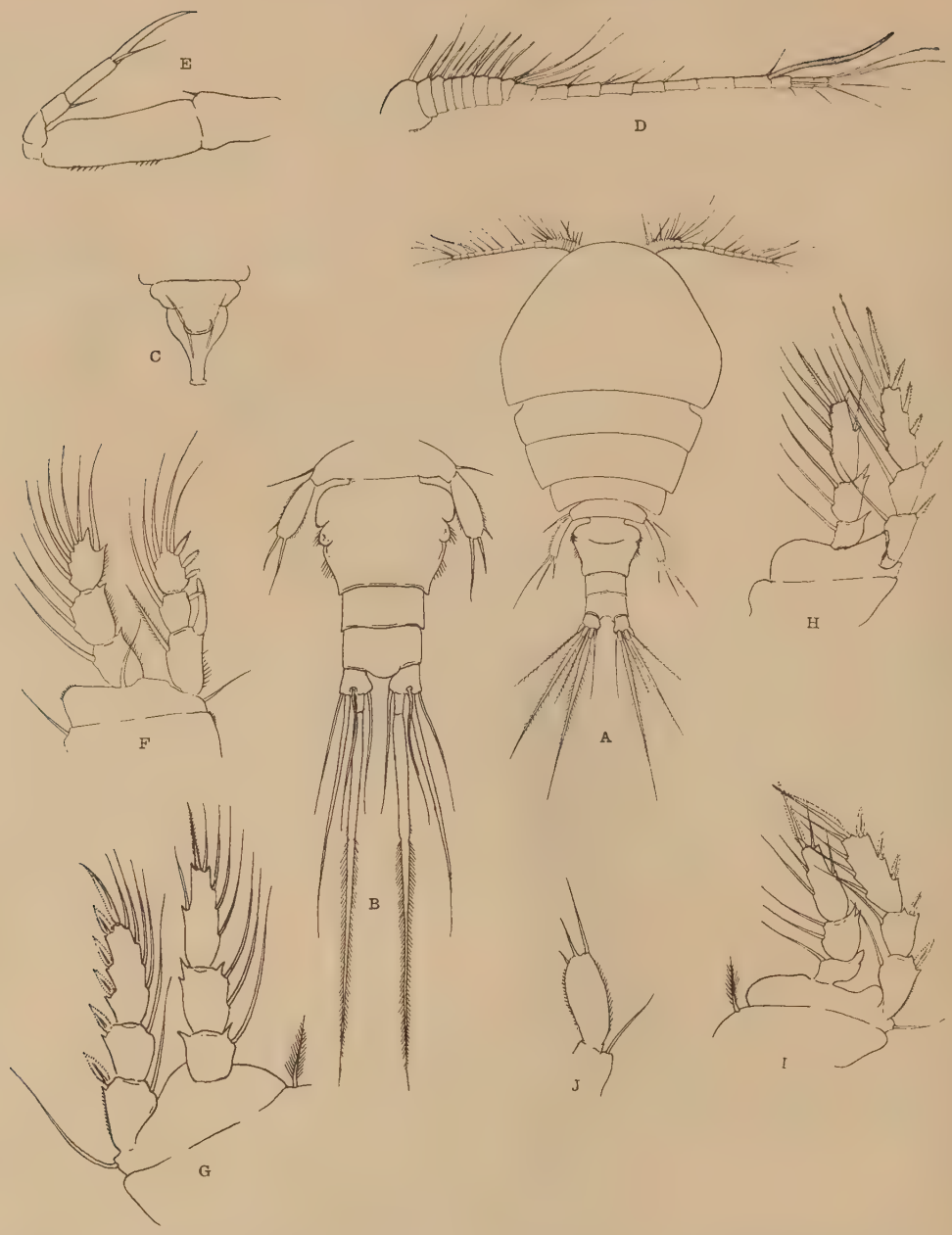
In its general shape (Text-fig. 9, A) the specimens resemble *Asterochere boecki* (Brady). The cephalon and 1st thoracic segment are fused and the combined mass is about one and one-third times as long as broad, the greatest breadth being situated at about the junction of the third and last quarters of the whole segment. The anterior margin is evenly rounded. The succeeding segments taper gradually. The abdomen (Text-fig. 9, B) is relatively short, the proportional lengths of the anterior and posterior regions of the body being in the proportion of 75 to 25. The proportional lengths of the segments of the abdomen are as follows :

	Abd. 1–2.	3.	4.	Furca.
(1) . . .	51	18	18	12 = 100 or
(2) . . .	52	18	17	13 = 100

The corresponding figures for *A. boecki*, as given by Giesbrecht (1899) are 45, 18, 21, 15, but according to Sars (1918, p. 91) Giesbrecht has confounded *A. boecki* (Brady) and *A. latum* (Brady) and, if this be so, one is uncertain to which species the measurements actually refer. The proportions of the segments are extremely close to those for *A. stimulans* Giesbrecht, which are 25, 9, 9, 6. The genital segment is slightly broader than long and is armed on its sides with a few needle-like spinules. The 2nd and 3rd free segments are much broader than long. The furcal rami are short being only about two-thirds the length of the anal segment and their breadth is at least equal to their length. The 2nd furcal seta is about twice the length of the whole abdomen and is markedly thickened at its base : the proximal one-third is smooth. The 3rd seta is about two-thirds the length of the 2nd and is also somewhat thickened, but much less so than the 2nd.

The 1st antenna (Text-fig. 9, D) is composed of 20 free segments, as in *A. stimulans* Giesbrecht, and the relative lengths of the proximal and distal parts also resemble those of that species.

The 2nd antenna possesses the form usual in the genus, and the end-claw is longer than the 1st segment of the endopod, as in *A. boecki* (Brady), *A. parvus* Giesbrecht, and



TEXT-FIG. 9.—*Asterocheres orientalis* sp. nov., ♀. A, Dorsal aspect. B, 5th thoracic segment and abdomen. C, Siphon. D, 1st antenna. E, Maxilliped. F, 1st swimming leg. G, 2nd swimming leg. H, 3rd swimming leg. I, 4th swimming leg. J, 5th leg.

A. stimulans Giesbrecht. The siphon (Text-fig. 9, C) is short and broad ; it reaches back to just beyond the level of the maxilliped and does not reach as far as the 1st foot, being thus, apparently, a little shorter than in *A. boecki* (Brady) and more nearly resembling that of *A. simulans* (T. Scott).

The mandibular palp is composed of the usual two segments : the terminal segment bears two setæ, of which one is about twice the length of the other.

The inner lobes of the 1st maxilla are much shorter than the 2nd basal segment, being only about one-fourth its length.

The 2nd maxilla is of the usual type.

The maxilliped (Text-fig. 9, E) has much the same shape and proportions as that of *A. stimulans* Giesbrecht (*cf.* Giesbrecht, 1899, pl. iii, fig. 12) : the 2nd basal segment bears a row of spinules, set in two groups, along the posterior border, and the end claw is also fringed with needle-like spinules along its distal half.

The setal formula of the swimming legs is as follows :

Leg.	Endopod.					Exopod.							
	1.	2.	3.			1.		2.		3.		
	Si.	Si.	Si.	St.	Se.	Si.	Se.	Si.	Se.	Si.	St.	Se.
P1	1	2	6			1	I	1	I	3	I	III
P2	1	2	6			1	I	1	I	4	I	III
P3	1	2	3	I	2	1	I	1	I	4	I	III
P4	1	2	2	I	2	1	I	1	I	4	I	III

In the 1st leg (Text-fig. 9, F) the exopod is slightly shorter than the endopod. The 1st segment of the exopod bears a stout, somewhat curved marginal spine that reaches as far as the level of origin of the 1st marginal spine of the 3rd segment. The 2nd segment of the exopod is about half the length of the 1st.

The 4th swimming leg (Text-fig. 9, I) agrees closely with Giesbrecht's descriptions and figures of the appendage in what he took to be *A. boecki* (Brady). The setæ of the endopod are considerably shorter than those of the other legs, as is the case also in *A. boecki* (Brady) and *A. latum* (Brady).

The 5th pair of legs (Text-fig. 9, J) are of moderate length, reaching back for about half the length of the genital segment of the abdomen. Each leg is composed of a basal part and one free segment, which is an elongate oval in shape and is about two and a half times as long as broad. Three unequal setæ arise from the distal end, the outermost being the longest and the inner the shortest and only about one-quarter the length of the outer.

The general colour of the body is a yellow-brown.

Remarks.—This species exhibits a close resemblance to several other species, but seems to conform to none of them. I have therefore thought it best to give it a specific name.

Distribution.—The Maldive Archipelago (present record).

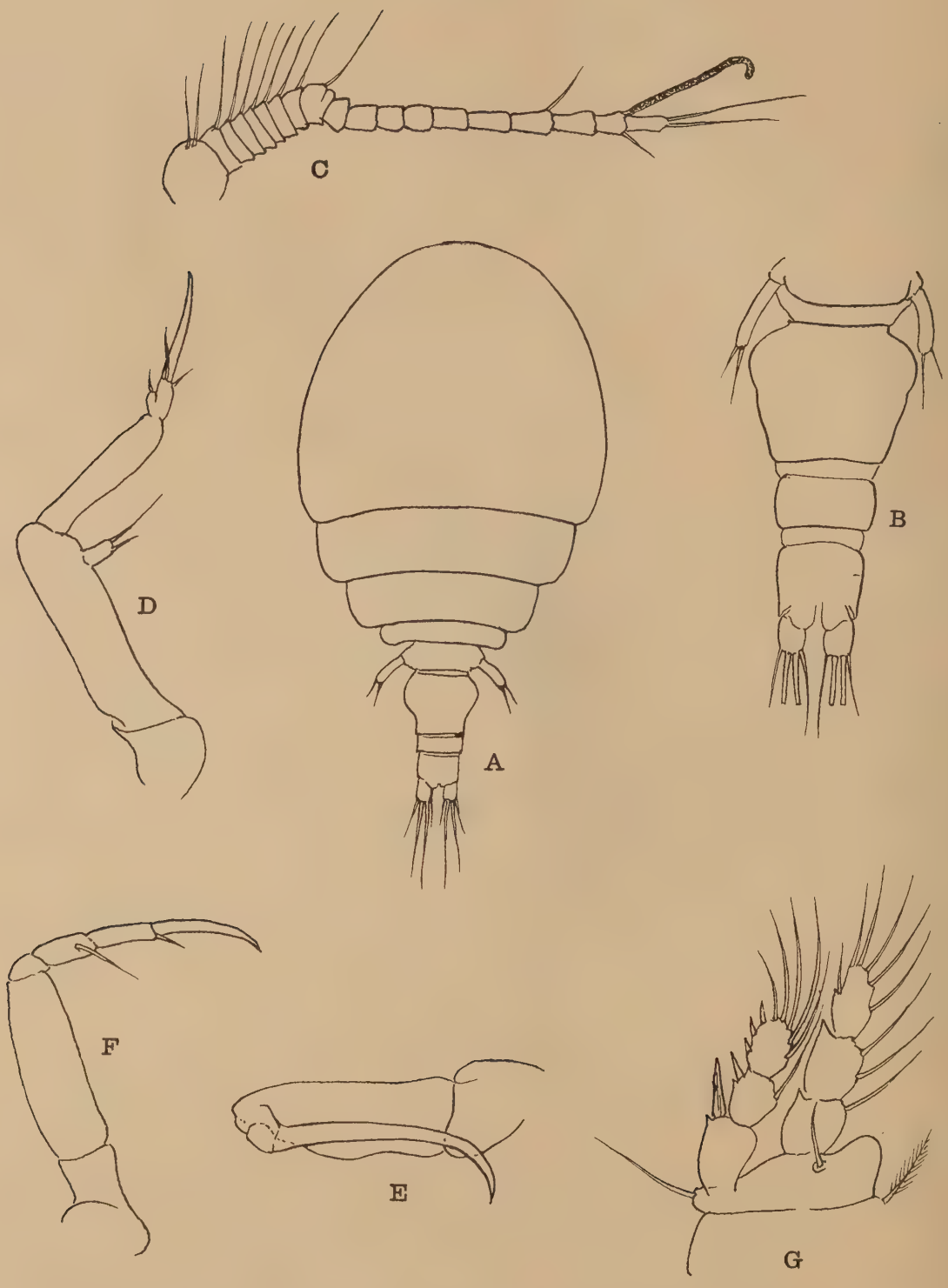
Asterocheres indicus sp. nov. (Text-fig. 10, A–G.)

Occurrence.—"John Murray" Expedition, Sta. 45 ; washings from Alcyonarians. One female.

Descriptive Notes.—♀. Total length 0·71 mm.

The proportionate lengths of the anterior and posterior regions are as 65 to 35. The anterior region is moderately expanded. The proportionate lengths of the various segments of the body are as follows :

Cephalon-h.	1.	2.	3.	4.	5.	Abd. 1–2.	3.	4–5	Furca.
396	127	86	26	51	137	51	76	40 = 1000	



TEXT-FIG. 10.—*Asterocheres indicus* sp. nov., ♀. A, Dorsal aspect. B, 5th thoracic segment and abdomen. C, 1st antenna. D, 2nd antenna. E, 2nd maxilla. F, Maxilliped. G, 1st swimming leg.

The head and 1st thoracic segment are fused. The lateral margins of the 2nd, 3rd and 4th thoracic segments are rounded. The genital segment of the abdomen is dilated in its anterior region and is without any spines on the lateral margins. There is only one free segment between the genital and anal segments; this is twice as wide as long. The anal segment is considerably longer than the preceeding segment and is nearly as long as wide. The furcal rami are articulated obliquely with the anal segment, so that the outer margin is twice the length of the inner border: the extreme length of the ramus is about one and a half times its breadth. The furcal setæ are relatively short, the 2nd, which is the longest, is about equal in length to the furcal ramus and the two preceeding segments of the abdomen together.

The rostrum is a depressed triangular plate with a rounded apex.

The 1st antenna (Text-fig. 10, C) appears to be composed of only 19 segments, the terminal three segments being fused together. The proportional lengths of the segments are as follows:

Segment	1.	2.	3.	4.	5.	6.	7.	8.	9–10.	11.	12.	13.	14.	15.	16.	17.	18.	19–20.	21–25.
	99	33	25	30	30	30	30	30	66	41	49	49	58	66	66	83	83	49	83

- 1000

The proximal part of the antennule is wide, whereas the distal portion is considerably narrower; the proportional lengths of the two portions are as 35 to 65. The 18th free segment, representing segments 19–20 in the Calanoid antenna, bears a long sensory filament. The terminal segments, 21 to 25, are fused together into a single joint. The whole appendage is relatively short and reaches back to about two-thirds the length of the cephalic segment.

The 2nd antenna (Text-fig. 10, D) has the form characteristic of the genus. The exopod is small and bears two unequal setæ.

The siphon is short and reaches back only as far as the sternite of the maxilliped, thus resembling the condition present in *A. lilljeborgi* Boeck, *A. simulans* T. Scott and *A. violaceus* Claus.

In the 1st maxilla the inner lobe and the 2nd basal segment are markedly unequal.

The 2nd maxilla (Text-fig. 10, E) forms a powerful grasping organ.

The maxilliped (Text-fig. 10, F) has the usual form.

The swimming legs resemble those of the other members of the genus. In the 1st leg (Text-fig. 10, G) the 1st segment of the exopod bears a stout straight spine that reaches as far as the tip of the marginal spine of exopod 2. The proximal marginal spine of exopod 3 is very small.

The 5th pair of legs are of moderate length and reach back to about the middle of the swollen part of the genital segment. They bear two unequal setæ at their distal ends.

Remarks.—This species appears to differ from most of those previously described by the great relative length of the anal segment, which is one and a half times as long as the preceeding segment: the anal segment is stated by Sars (1913–18) to be longer

than the preceeding segment in *Ascomyzon asterocheres* Sars* (= *Asterocheres lilljeborgi* (Boeck), *A. siphonatus* Giesbrecht (= *A. lilljeborgi* Thorell), *A. boecki* Brady and *A. latum* (Brady); but in none of these is it as long as in the present specimen. In the first three species the furcal rami are short, as in the present example, whereas in *A. latum* they are as long as the anal segment. In *A. siphonatus* Giesbrecht the siphon is extremely long and even in *A. boecki* Brady it reaches to the level of the sternite of the 1st leg. Thus this example seems to come nearest to *A. lilljeborgi* Boeck, but in this species the two branches of the maxillary palp are only moderately unequal, whereas in the present specimen this difference is marked. The shape of the body, too, is quite different from that of *A. lilljeborgi* Boeck, and in consequence the specimen must, I think, be regarded as an example of a new species.

Distribution.—South coast of Arabia (present record).

Asterocheres ovalis sp. nov. (Text-fig. 11, A–I.)

Occurrence.—"John Murray" Expedition, Sta. 10; washings from an Ascidian. One male.

Descriptive Notes.—♂. Total length 0·45 mm.

The proportional lengths of the anterior and posterior regions (Text-fig. 11, A) are as 79 to 21, the abdominal region being exceptionally short. The anterior region forms a wide oval. The proportional lengths of the various segments of the body are as follows:

Cephalon-Th. 1.	2.	3.	4.	5.	Abd. 1.	2.	3.	4–5.	Furca.
533	89	89	44	15	133	22	15	30	30 = 1000

The head and 1st thoracic segment are fused; the 5th thoracic segment is very short. The genital segment is markedly expanded and forms a broad oval, being wider than long: the lateral margins are armed with a row of minute spinules and at the postero-lateral angles the genital plates are produced in a triangular process from which arises a single small setæ. The next two abdominal segments are very short, being much wider than long. The anal segment is twice as long as the preceding segment and the furcal rami are as broad as long. They bear five setæ.

The 1st antenna (Text-fig. 11, B) is composed of only 14 free segments: segments 2 and 3 are fused, and so are segments 4–7 inclusive. In this latter feature this species appears to differ from all other known males in the genus and resembles the condition found in the genus *Acontiophorus*. The proportional lengths of the segments are as follows:

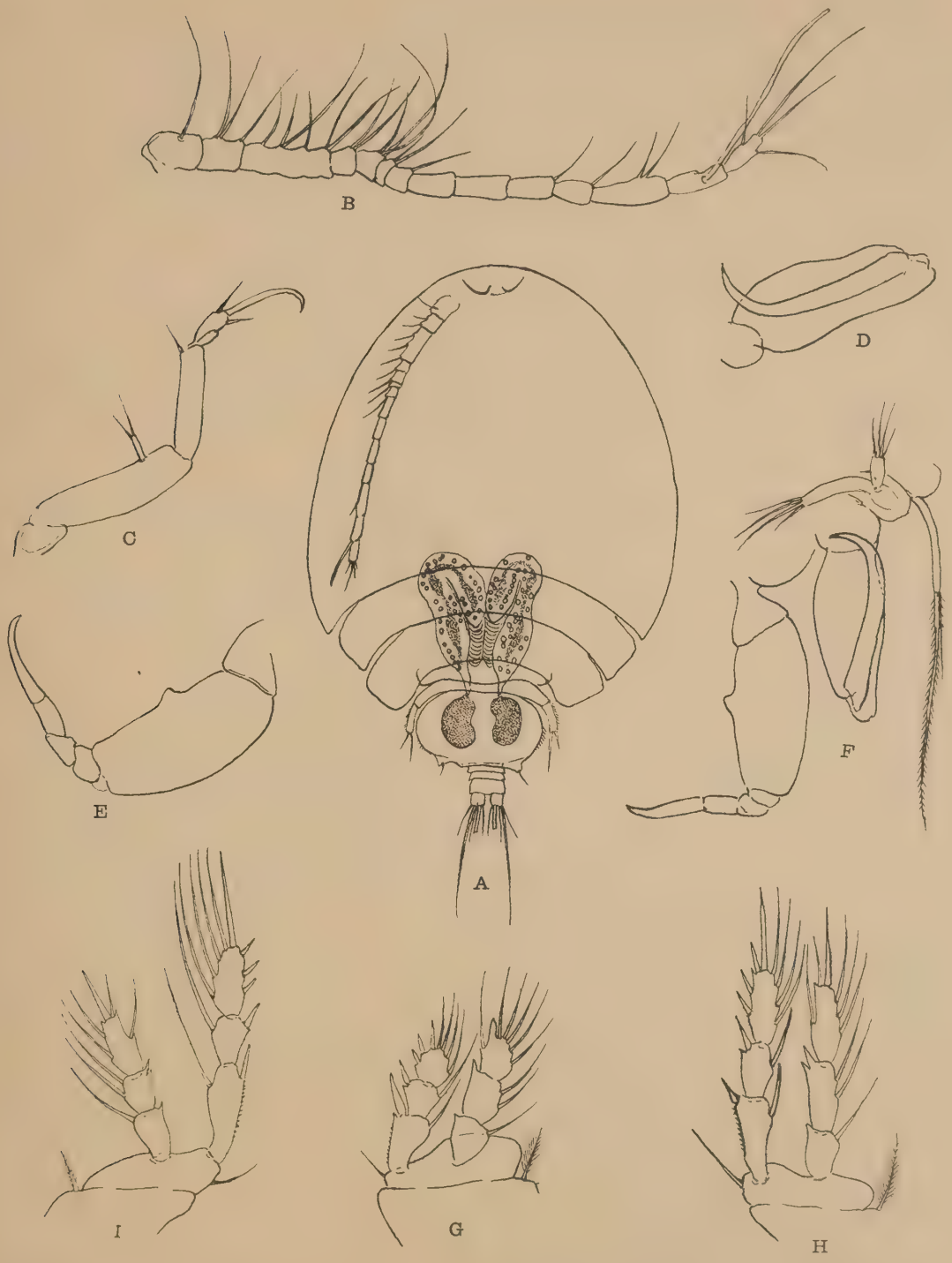
Segment 1.	2–3.	4–7.	8.	9–10.	11.	12.	13.	14.	15.	16.	17–18.	19–21.	22–25.
86	70	141	42	42	28	42	70	85	70	56	112	86	70 = 1000

The mandibular palp is of the usual form and bears two unequal setæ at its distal end.

The maxillary palp bears two unequal rami.

The 2nd maxilla (Text-fig. 11, D) forms a powerful grasping organ.

* Sars (1913–18, p. 86), ignoring the Rules of Nomenclature, adopted the generic name *asterocheres* as the specific name of the species *Asterocheres lilljeborgi* Boeck, in order to avoid changing the specific name of *Ascomyzon lilljeborgi* Thorell, although, as he himself admits, Boeck's paper was published first and therefore has priority.



TEXT-FIG. 11.—*Asterocheres ovalis* sp. nov., ♂. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, 2nd maxilla. E, Maxilliped. F, Mouth-parts *in situ*. G, 1st swimming leg. H, 3rd swimming leg. I, 4th swimming leg.

In the maxilliped (Text-fig. 11, E) the 2nd basal segment bears on its anterior margin a small triangular prominence, as in the males of other species.

The swimming legs have the usual characters. The 1st segment of the exopod of the 1st leg (Text-fig. 11, G) bears an inner seta. The 3rd and 4th legs (Text-fig. 11, H and I) are somewhat slender and in the 4th leg the endopod only reaches to about the end of the 2nd segment of the exopod.

The 5th pair of legs are of moderate length and bear, so far as I could discover, only two unequal setæ at the distal end : the outer margin of the free segment is armed with a row of small spinules.

Genus *Asteropontius* Thompson and A. Scott.

Asteropontius, Thompson and A. Scott, 1903, p. 288.

This genus was created by Thompson and A. Scott to accommodate two species that were taken on the Ceylon Pearl Banks, *A. typicus* and *A. attenuatus*. The present collection contains what appears to be a third species.

Asteropontius nicobaricus sp. nov.

Occurrence.—Nankauri Harbour, Nicobar Islands ; in weed-washings. Two females.

Descriptive Notes.—♀. Total length 0·62 and 0·70 mm.

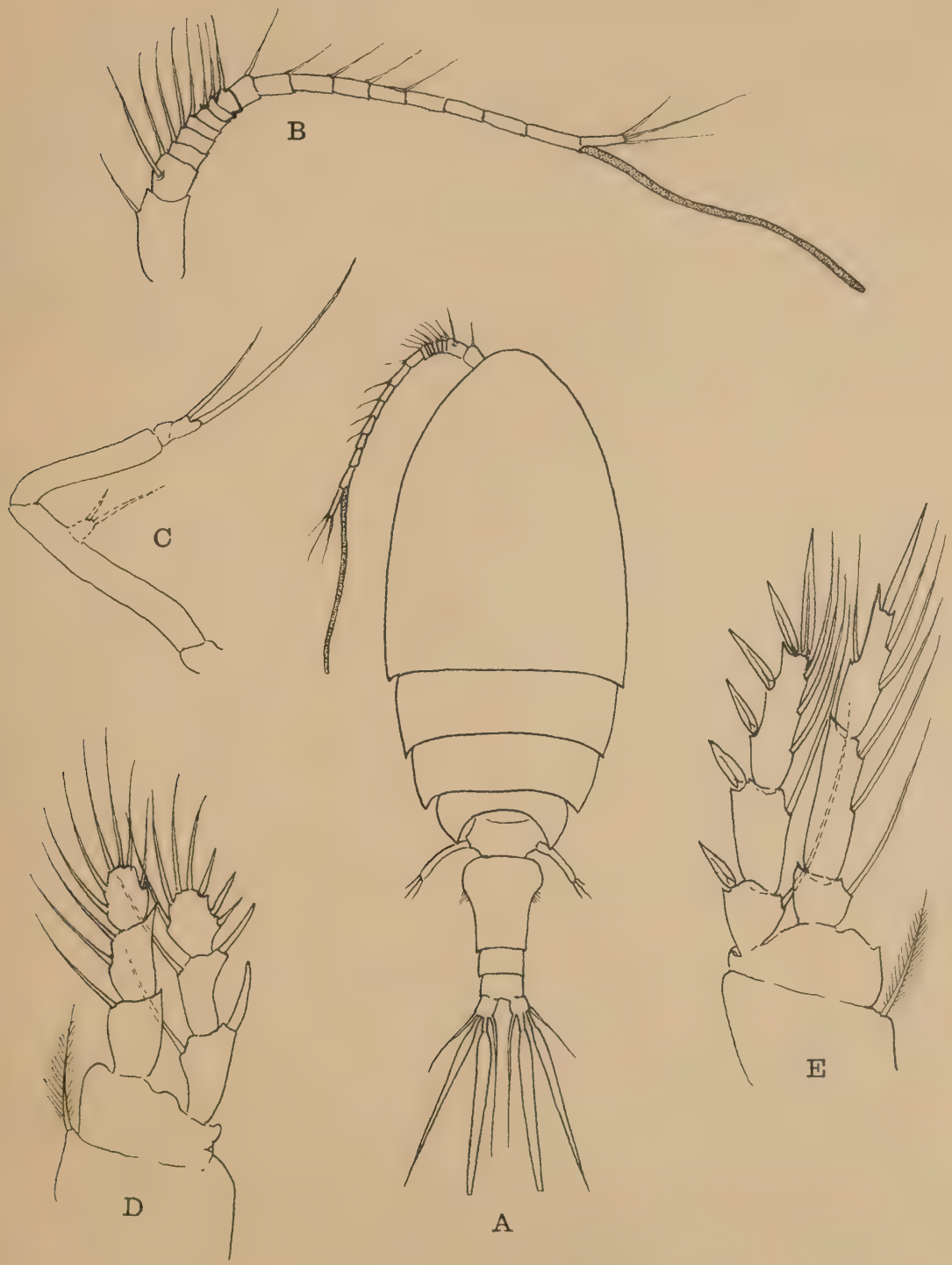
The proportional lengths of the anterior and posterior regions of the body are as 68 to 32. The proportional lengths of the segments of the abdomen are as follows :

Abd. 1–3.	4.	5.	Furca.
54	20	15	11 = 100

The cephalothorax is an elongate oval, closely resembling the form in *A. attenuatus* Thompson and A. Scott. The cephalon and 1st thoracic segment are fused and the combined segment is twice the length of the following three segments. The abdomen is relatively short. The genital segment is considerably swollen in its anterior third, and where it narrows there is on each side a small tuft of fine spinules. The furcal rami are slightly broader than long, in the proportion of 5 to 4. The 2nd and 3rd setæ are considerably thickened, especially the 2nd.

The 1st antenna reaches back to about half the length of the cephalic segment. It is composed of 18 segments, thus differing from *A. typicus* Thompson and A. Scott, which possesses 19, and resembling *A. attenuatus* Thompson and A. Scott. The proximal segment is long ; the 2nd is about half the length of the first ; then follow six segments of approximately equal length ; the 9th segment is somewhat longer and narrower than the 8th ; beyond this are eight segments that are considerably narrower than the more proximal segments and that gradually increase in length, till the 17th, which is about three times as long as wide and carries a long sensory filament ; beyond this is a single segment bearing a tuft of setæ distally.

The 2nd antenna is of the same type as that of *Astercheres*. The 1st basal segment is short ; the 2nd basal is long and narrow. The endopod was unfortunately missing. The exopod is composed of three segments of which the proximal is long and narrow and about three-fourths the length of the 2nd basal. The two distal segments are very short



TEXT-FIG. 12.—*Asteropontius nicobaricus* sp. nov., ♀. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, 1st swimming leg. E, 4th swimming leg.

and the distal is produced in a conical prominence, from the side of which arises a curved long spine.

The maxilliped, which was somewhat damaged, appears to resemble that of *A. attenuatus* (*cf.* Thompson and A. Scott, 1903, pl. xviii, fig. 17).

The siphon is long and slender and reaches back to the sternum of the 2nd leg.

In the 1st swimming leg the 1st basal segment bears a seta internally. The endopod and exopod are of about equal length. The 1st segment of the exopod bears a long, slightly curved marginal spine that reaches as far as the origin of the marginal spine on the 2nd segment. The 2nd segment is markedly emarginate on its outer border. The 3rd segment is short and bears three marginal spines, but the terminal spine is replaced by a seta.

In the 4th leg the endopod is somewhat longer than the exopod and the segments of the rami are long and slender.

The 5th leg is of moderate length and reaches back to about one third the length of the genital segment : it appeared to have three setæ arising from the distal end.

One of the females was ovigerous and carried a single egg on each side.

Family Acontiophoridæ.

Genus *Acontiophorus* Brady.

Acontiophorus, Brady, 1880, p. 69 ; Canu, 1892, p. 270 ; Giesbrecht, 1899, p. 103 ; Sars, 1918, p. 110.

At the present time this genus includes four species. Of these the first two, *Acontiophorius scutatus* and *A. ornatus* were described by Brady. In 1923 Hansen added a third species, *A. antennatus*, that agrees in the main with *A. scutatus* and Nicholls in 1944 has recorded a fourth species, *A. zealandicus*, which he claims is the form recorded by Thomson (1883) from New Zealand under the name *A. scutatus*. The present collections contain yet another species, which appears to be new and to which I have given the name *maldivensis*. This new species is more nearly related to *A. ornatus* Brady than to the other previously known members of the genus ; Sars (1913–18, p. 109) has suggested that *scutatus* and *ornatus* should be regarded as types of two different, though closely related, genera, *scutatus* being the type of the genus *Acontiophorus*. If in the future *ornatus* be made the type of a new genus, the present species will have to be removed from *Acontiophorus* and be included with *ornatus* in the new genus.

Acontiophorus maldivensis sp. nov. (Text-fig. 13, A–H.)

Occurrence.—Addu Atoll, Maldive Archipelago ; in weed-washings. Two females.

Descriptive Notes.—♀. Total length 0·64 mm.

The proportional lengths of the anterior and posterior regions of the body are as 70 to 30 The anterior region of the body (Text-fig. 13, A) is oval in outline, resembling that of *A. ornatus* Brady ; the greatest width, which is situated about the posterior end of the cephalon, is less than half the total length of the animal. The head and 1st thoracic segment are fused. Viewed from the dorsal aspect the lateral margins of the thoracic segments appear to be produced backwards in sharp points, as in *A. ornatus* Brady. The abdominal segments have the following proportional lengths :

Abd. 1–3.	4.	5.	Furca.
56	19	12	13 = 100

TEXT-FIG. 13.—*Acontiophorus maldivensis* sp. nov., ♀. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, 1st maxilla, and plumose seta of the mandible. E, 2nd maxilla. F, 1st swimming leg, basal segments and exopod. G, 4th leg. H, 5th leg.

The genital segment is broad anteriorly but tapers towards the posterior margin. The following two segments are considerably broader than long and their lateral margins show no sign of being produced backwards. The furcal rami are short and broad, as in *A. ornatus* Brady.

The 1st antenna (Text-fig. 13, B) is relatively short, reaching back only about one half the length of the cephalon : it consists, as in *A. ornatus* Brady, of 16 free segments, of which the 1st and 3rd are long and are of about equal length, being separated by a short 2nd segment. Segments 4 to 8 are short and are considerably broader than long : segments 9–11 are somewhat longer but are still broader than long ; segments 12 and 13 are very slightly longer than broad, and the latter segment bears a long sensory filament ; the three terminal segments are slightly more slender.

The 2nd antenna (Text-fig. 13, C) is biramous : the 2nd basal segment is about three times as long as broad and bears a tuft of fine hairs on the inner border near the distal end. The external ramus is composed of a single segment that is approximately equal in length to the 1st segment of the inner ramus : it bears a short seta near the proximal end and a long plumose seta distally. The inner ramus is composed of two segments, the 2nd being considerably shorter than the 1st, so that in this respect this species differs from both *A. ornatus* Brady and *scutatus* Brady. The terminal segment bears a plumose seta near the base, a stiff smooth seta on its outer margin a little beyond the middle of its length, and distally two unequal spines, of which the shorter is stout and blunt and is nearly equal in length to the segment, while the longer seta is about three times the length of the segment.

The siphon is very long and slender and reaches back to the genital segment of the abdomen, thus resembling *ornatus*.

The mandible bears a single long plumose seta.

The 1st maxilla (Text-fig. 13, D) has two very unequal lobes. On the longer inner lobe are four unequal setæ. The 2nd maxilla (Text-fig. 13, E) closely resembles that of *A. ornatus* Brady.

In the 1st leg (Text-fig. 13, F) the 1st basal segment bears an inner seta and the 2nd basal carries a small seta externally and a stout serrated spine on its inner border. In the exopod the 1st segment bears a well-developed marginal spine and has a single seta internally. The marginal spines of the 3rd segment are comparatively small and the end-spine is replaced by a plumose seta. The endopod in the specimen dissected was unfortunately missing.

In the 4th leg (Text-fig. 13, G) the 3rd segment of the endopod bears a single seta on its outer margin ; a stout spine, that is approximately the same length as the segment, on its distal margin, and two setæ on the inner border.

The 5th leg (Text-fig. 13, H) consists of two segments. The basal bears a single seta externally. The distal free segment is short and broad and carries only four setæ, one on the outer margin, one at the distal extremity and two on the inner border. This appendage thus differs from that of both *scutatus* Brady and *ornatus* Brady, which normally bear five setæ, but it shows considerable resemblance to what Giesbrecht (1899, pl. iv, fig. 44) considered to be an abnormal limb.

Family Dyspontiidæ.

Genus *Pteropontius* Giesbrecht.

Giesbrecht (1899, pp. 36, 110) created this genus to accommodate the species *Pteropontius cristatus*, examples of which he had obtained from Naples in the Mediterranean Sea. A second species *P. scaber* was created by Brady (1910, p. 583, text-fig. lxvi) to

accommodate a single specimen taken by the " Gauss " in the Antarctic. Nicholls (1944) added a third species *P. barbatus* from Australia. A single example of what appears to be a fourth species was taken by the " John Murray " Expedition.

Pteropontius quartus sp. nov. (Text-fig. 14, A–J.)

Occurrence.—" John Murray " Expedition. In debris from Sta. 24, Gulf of Aden, depth 73–220 m. A single female.

Descriptive Notes.—♀. Total length 0·93 mm.

This is much the same length as Giesbrecht's species *cristatus*, which measured 0·8–1·1 mm., whereas Brady's example of *scaber* was much larger, measuring 3·5 mm. Nicholl's example of *barbatus* measured 1·02 mm.

The proportional lengths of the anterior and posterior regions of the body are as 69 to 31.

The proportional lengths of the various segments of the body are as follows :

Cephalon-Th. 1.	Th. 2.	3.	4.	5.	Abd. 1–2.	3.	4.	5.	Furca.
534	59	59	40	31	107	47	40	43	40 = 1000

The head and 1st thoracic segment are fused. In the present specimen, as in *P. scaber* Brady, the pleura of this combined segment are curved downwards and inwards round the side of the body (Text-fig. 14, B). The cuticle of the dorsal aspect appears to be quite smooth, and there appeared to be no dorsal crest, thus differing from the condition present in the other three species. The rostrum is a triangular plate. The lateral regions of the 2nd and 3rd segments of the thorax are produced outwards and backwards in pointed wings. The lateral part of the 4th segment is much less produced and terminates in a sharp point. The genital segment is widely dilated in its anterior part and then narrows abruptly. There are two free segments between the genital and anal segments. The furcal rami are slightly shorter than the anal segment and are about one and a quarter times as long as broad. There are five setæ on each ramus ; the 2nd seta is the longest and stoutest and is longer than the whole posterior region of the body.

The 1st antenna (Text-fig. 14, C) is short and is composed of eight segments that have the following proportional lengths :

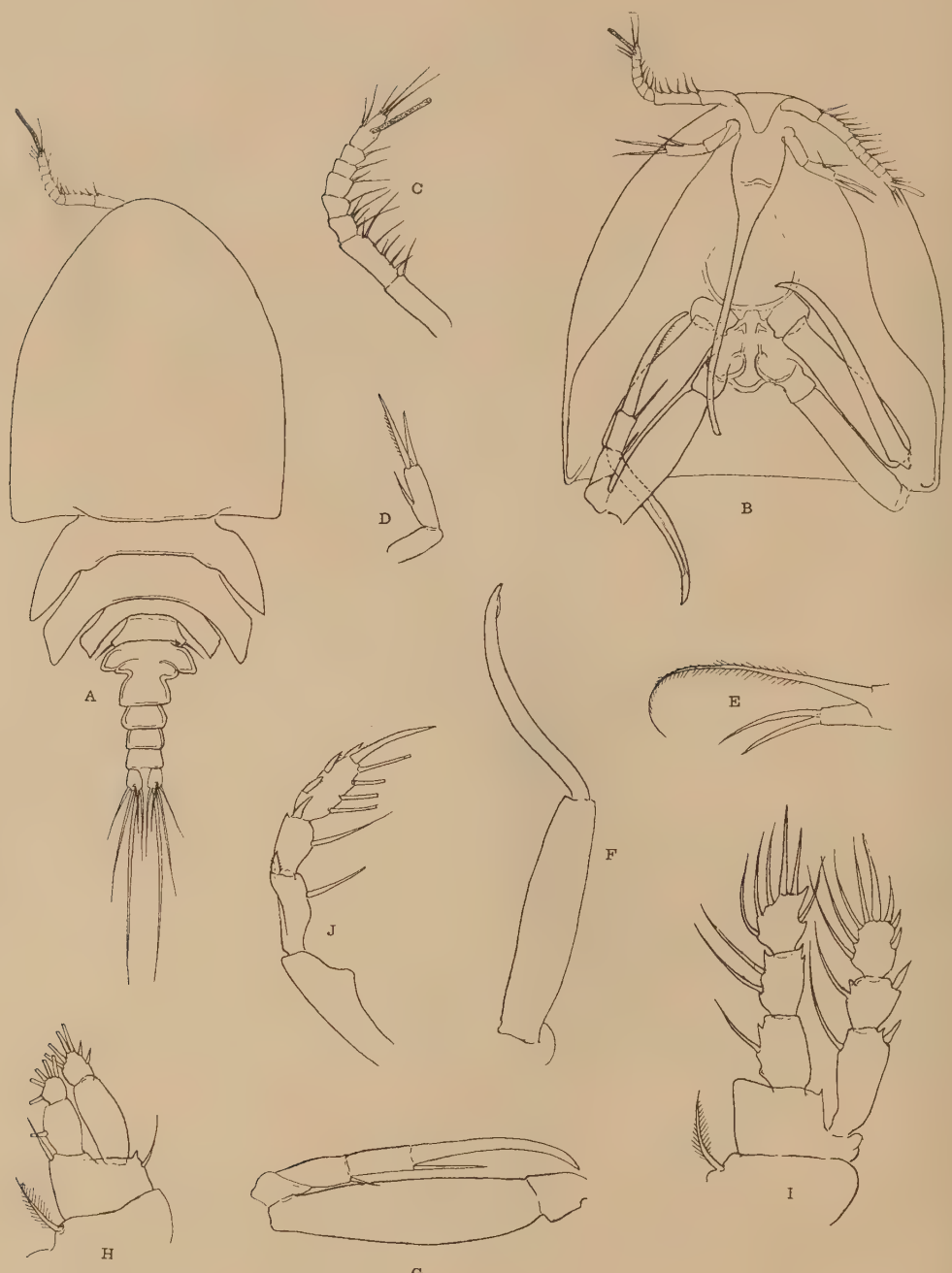
Segment 1.	2.	3.	4.	5.	6.	7.	8.
34	22	8	6	7	5	6	12 = 100

The terminal segment bears a short and stout sensory filament, that arises about half-way along its length.

The 2nd antenna (Text-fig. 14, D) closely resembles that of *P. cristatus* Giesbr.

The siphon is produced in a long and slender tube that reaches back beyond the sternite of the maxilliped ; it thus appears to be somewhat longer than in *P. cristatus* Giesbr. and very much longer than in *P. scaber* Brady, and *P. barbatus* Nicholls.

I was unable to examine the mandible, but the 1st maxilla (Text-fig. 14, E) appears to have the same structure as in *P. cristatus* Giesbr., the 2nd basal segment bears two subequal spine-like processes and the inner lobe carries a single long feathered seta.



TEXT-FIG. 14.—*Pteropontius quartus* sp. nov, ♀. A, Dorsal aspect. B, Cephalothorax, ventral view. C, 1st antenna. D, Exopod of 2nd antenna. E, 1st maxilla. F, 2nd maxilla. G, Maxilliped. H, 1st swimming leg. I, 2nd swimming leg. J, 4th swimming leg.

The 2nd maxilla (Text-fig. 14, F) forms a grasping organ, the terminal claw being longer than the whole basal part of the limb.

The maxilliped (Text-fig. 14, G) also forms a grasping organ of the usual type.

In the 1st pair of legs (Text-fig. 14, H) both rami are composed of only two segments, as in the type species, but in the present example the proximal segment of the exopod is about three times as long as the distal, whereas in *P. cristatus* Giesbr. they are of approximately equal length, and in *P. barbatus* Nicholls the distal segment is longer than the proximal.

In the 4th leg (Text-fig. 14, J) the endopod is represented merely by a rounded prominence on the margin of the 2nd basal segment.

The 5th leg is reduced to a single seta.

PŒCILOSTOMA.

In this section of the Copepoda Cyclopoida there is a reduction in the mouth-parts. Brady (1880, p. 39) in his account of the family Saphirinidæ, in which he includes the genus *Lichomolgus*, gives the following characters, "Mandibles small, subulate, with a tapering extremity or divided into a few slender teeth ; maxilla composed of a single small setigerous digit attached near the base of the mandible," and in the account of the genus *Lichomolgus*, he remarks, "Mandible forming a slender ciliated stilet, dilated at the base but excessively slender and filiform beyond the middle ; no palp. Maxilla springing from near the base of the mandible, composed of a digitiform process, which bears a few setæ." This view of the composition of the mouth-parts has been accepted by most carcinologists. Thompson and A. Scott (1903), however, in their report of the Copepoda of the Ceylon Pearl Banks, appear to consider that the maxilla is completely absent, for in their account of a number of species belonging to this section they describe the most anterior of the oral appendages as the mandible and its palp, and make no mention of the 1st maxilla. Sars (1913–18, p. 142) claims that it is the mandible that is missing in this Group, and that the appendage that was regarded by earlier writers as the combined mandible and 1st maxilla, or as the mandible and its palp, is in reality the 1st maxilla and its palp. Gurney (1927*b*, p. 464) has reviewed the situation and he is convinced that "the mouth-parts of these Copepoda are actually the same as in others, namely mandible, 1st maxilla, 2nd maxilla and maxilliped." Nicholls (1944, p. 44) has also reviewed the position and his conclusions agree with Gurney's. In the following account I have adopted this view, but the different opinions of earlier writers must be borne in mind when comparing figures of the mouth-parts in this paper with those figured by authors in earlier works.

Family Clausidiidæ.

In this family, as Nicholls (1944, p. 46) has pointed out, there are at present six known genera, namely :

Hemicyclops Boeck.
Clausidium Kossmann.
Hersiliodes Canu.
Giardella Canu.
Goidelia Embleton.
Hippomolgus Sars.

The early developmental stages in all the genera of this family appear to have a close resemblance. Canu (1888) has described the 1st Copepodid stage in a series of *Giardella*,

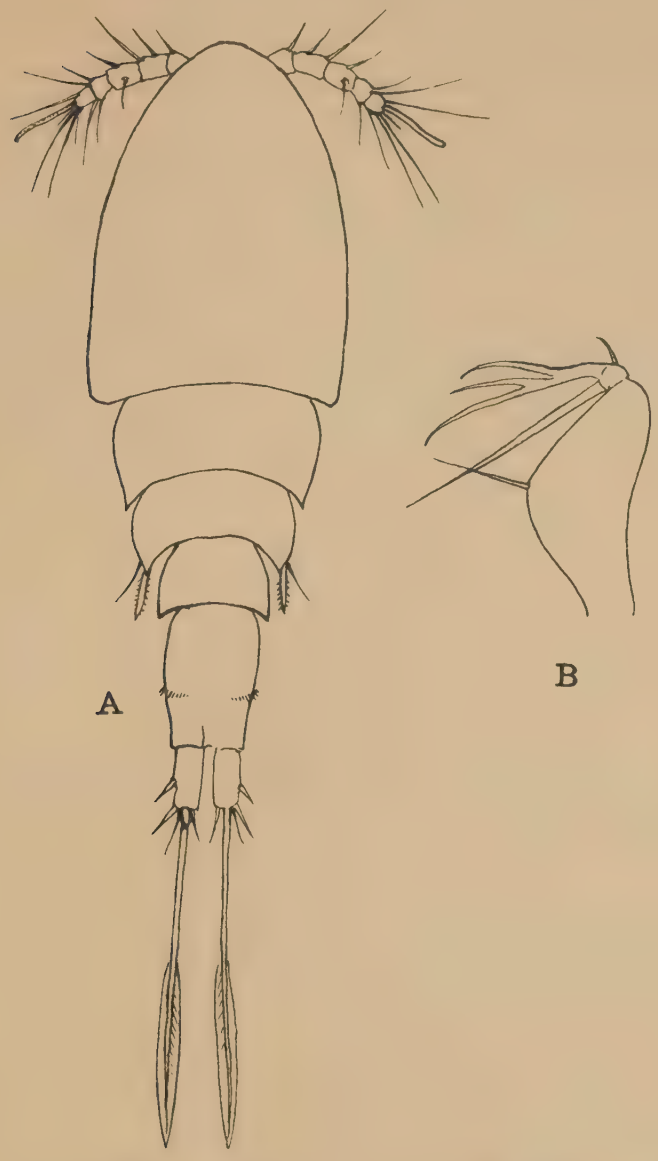
and the 2nd Copepodid stage in *Hersiliodes pelseneeri* and *H. puffini*. T. Scott (1894), under the name "*Saphirella abyssalis*," described another form, which he had obtained from the Gulf of Guinea and Wolfenden (1906) recorded a second species of this so-called genus, *S. tropica*, from the Maldive Archieplago. In 1924 I recorded a third species, *Saphirella indica*, from the Chilka Lake, and I then put forward the view that the form described by Brady (1899) from New Zealand under the name *Paurocope robusta* was another species of this genus: Nicholls (1944) has obtained what he believes to be a specimen of *Saphirella tropica* from the south of Australia, and he has reached the conclusion that this form is the 1st copepodid stage of a species of *Hemicyclops*, but he attributes Brady's form *Paurocope robusta* to a genus that is at present unknown, but which belongs to the same family. Such a conclusion might be justified, if we could be certain of the accuracy of Brady's figures, but, as Nicholls himself points out, " Brady's fig. 5 (pl. xiii) may truly represent the mandible as claimed by him. His fig. 6, which he calls the maxilla (maxillule) is certainly not that appendage, but might be either the terminal portion of the maxilla (2nd maxilla) or, more likely, the end of the mandible showing the terminal claw with three accessory pieces (in this case two toothed blades and one seta) typical of three out of the six known genera. His fig. 7 is unrelatable to any other recognizable mouth-part, though the terminal portion might represent the maxillule as suggested by Sewell. The proximal portion bears no relationship to any of the mouth-parts known for this family."

Among the present collections I found a single specimen of what appears to be yet another species of "*Saphirella*" (Text-fig. 15). The thoracic region differs somewhat from that of the previously described species in that the postero-lateral angles of the 1st free thoracic segment are not markedly produced backwards, much less so than in *Saphirella tropica* Wolfend. and *S. abyssalis* T. Scott. Unfortunately I have no record of any of the mouth-parts except the maxilliped, but this differs in detail from all the previously described forms, for the outer spine arising from the small terminal segment is armed with two curved claw-like branches, and there appeared to be only a single spine arising from the swollen basal segment. I propose the name *Saphirella nicobarica* for this form.

The known species of this genus Saphirella fall into two groups according to the length of the furcal rami. In the first group these rami are very short, and included in this group are *Saphirella abyssalis* T. Scott (1894) from the Gulf of Guinea and the Malay Archipelago, and *Saphirella tropica* Wolfenden (1906) from the Maldive Archipelago, the Great Barrier Reef of Australia and the south coast of Australia (Nicholls, 1944). In the 2nd group the furcal rami are much longer, being nearly one third the length of the abdominal segment and twice as long as broad; in this group are *Saphirella indica* Sewell (1924) from the Chilka Lake and *S. nicobarica* (present record) from Nankauri Harbour in the Central group of the Nicobar Islands. If Nicholls is right in attributing the forms of *Saphirella* to the genus *Halicyclops*, it is possible that these two latter forms represent the 1st copepodid stage of *Halicyclops tenuispina* Sewell, which was recorded from the Chilka Lake and *H. indicus* sp. nov., which was taken in Nankauri Harbour.

Throughout the Pœcilostoma the setal formula of the swimming legs possesses little or no value as a diagnostic character. Within a single genus different species may possess different formulæ, and this is especially the case in the 4th swimming leg.

In the family Clausidiidæ the genus *Hemicyclops* exhibits a progressive variation in the arrangement of spines and setæ in different species. Light and Hartman (1937) have



TEXT-FIG. 15.—"*Saphirella nicobarica*" sp. nov. A, Dorsal aspect. B, Maxilliped.

given a revised list of the species, which they consider should be referred to this genus, namely :

Hemicyclops purpureus Boeck (= *Lichomolgus littoralis* T. Scott).
H. aberdonensis T. and A. Scott.
H. adherens (Williams).
H. americanus Wilson.
H. callianassæ Wilson.
H. thysanotus Wilson.
H. pugettensis Light and Hartman.

and to these must be added species that since that date have been described by other authors, namely:

Hemicyclops elongatus Wilson,
H. australis Nicholls,
and *H. indicus* sp. nov.

It would seem probable that two of the species described by Thompson and A. Scott (1903) from the Ceylon Pearl Banks and referred by them to the genus *Hersiliodes*, namely *H. leggii* and *H. tamilensis*, should also be included. In the present collection are several examples of what appears to be a new species, which I have named *Hemicyclops indicus*.

In several of these species we have no description of the details of the swimming legs, but among those that have been described we find that the simplest formula occurs in *Hemicyclops australis* Nicholls and *H. leggii* (Thompson and A. Scott) and perhaps also in *H. tamilensis* (Thompson and A. Scott): in these species the setal formula of the swimming legs is as follows:

	Endopod.			Exopod.		
	1.	2.	3.	1.	2.	3.
	Si.	Si.	Si. Se.	Si. Se.	Si. Se.	Si. St. Se.
P1	1	1	5, I	0, I	1, I	5, 1, II
P2	1	2	3, III	0, I	1, I	5, I, III
P3	1	2	2, IV	0, I	1, I	5, 1, III
P4	1	2	1, IV	0, I	1, I	5, I, II

In *H. purpureus* Boeck, with which, according to Sars, *H. littoralis* (T. Scott) is synonymous, and in *H. americanus* Wilson the formula for the 4th leg is

P4	1	2	2, III	0, I	1, I	5, I, II

One of the spines in the terminal segment of the endopod being replaced by a seta.

In *H. pugettensis* Light and Hartman the formula is

P4	1	2	2, III	0, I	1, I	7, II

Here the formula for the endopod is similar to that of *H. purpureus* Boeck, but on the terminal segment of the exopod the number of setæ is increased by two, whereas the number of spines is reduced by one only.

In *H. indicus* sp. nov. the setal formula for the last swimming leg is

P4	1	2	3, III	0, I	1, I	5, I, III

and finally in *H. aberdonensis* (T. Scott) it is

P4	1	2	3, IV	0, I	1, I	5, I, III

To a somewhat less extent similar differences are to be found in the more anterior swimming legs, thus in the 1st leg we get

P1	1	1	5, I	0, I	1, I	5, 1, II

in *H. purpureus* Boeck, *H. pugettensis* Light and Hartman, *H. indicus* sp. nov., and *H. australis* Nicholls, but

P1 . 1 1 5, I . 0, I 1, I . 4, I, III

in *H. americanus* Wilson and *H. elongatus* Wilson. One seta has been lost in the endopod, giving

P1 . 1 1 4, I . 0, I 1, I . 4, I, III

in *H. leggii* (Thompson and A. Scott). In the 2nd leg the formulæ for different species are

P2	.	1	2	3, III	.	0, 1	1, I	. 7, II in *H. pugettensis* Light and Hartman.
P2	.	1	2	3, III	.	0, I	1, I	. 5, 1, III in *H. purpureus* Boeck.
P2	.	1	2	3, III	.	0, I	1, I	. 5, I, III in *H. australis* Nicholls and *H. indicus* sp. nov.

Genus *Hemicyclops* Boeck.

Hemicyclops indicus sp. nov. (Text-fig. 16, A–I.)

Occurrence.—Nankauri Harbour, Nicobar Islands, in weed-washings; several females and one male.

Descriptive Notes.—♀. Total length 1·07 mm.

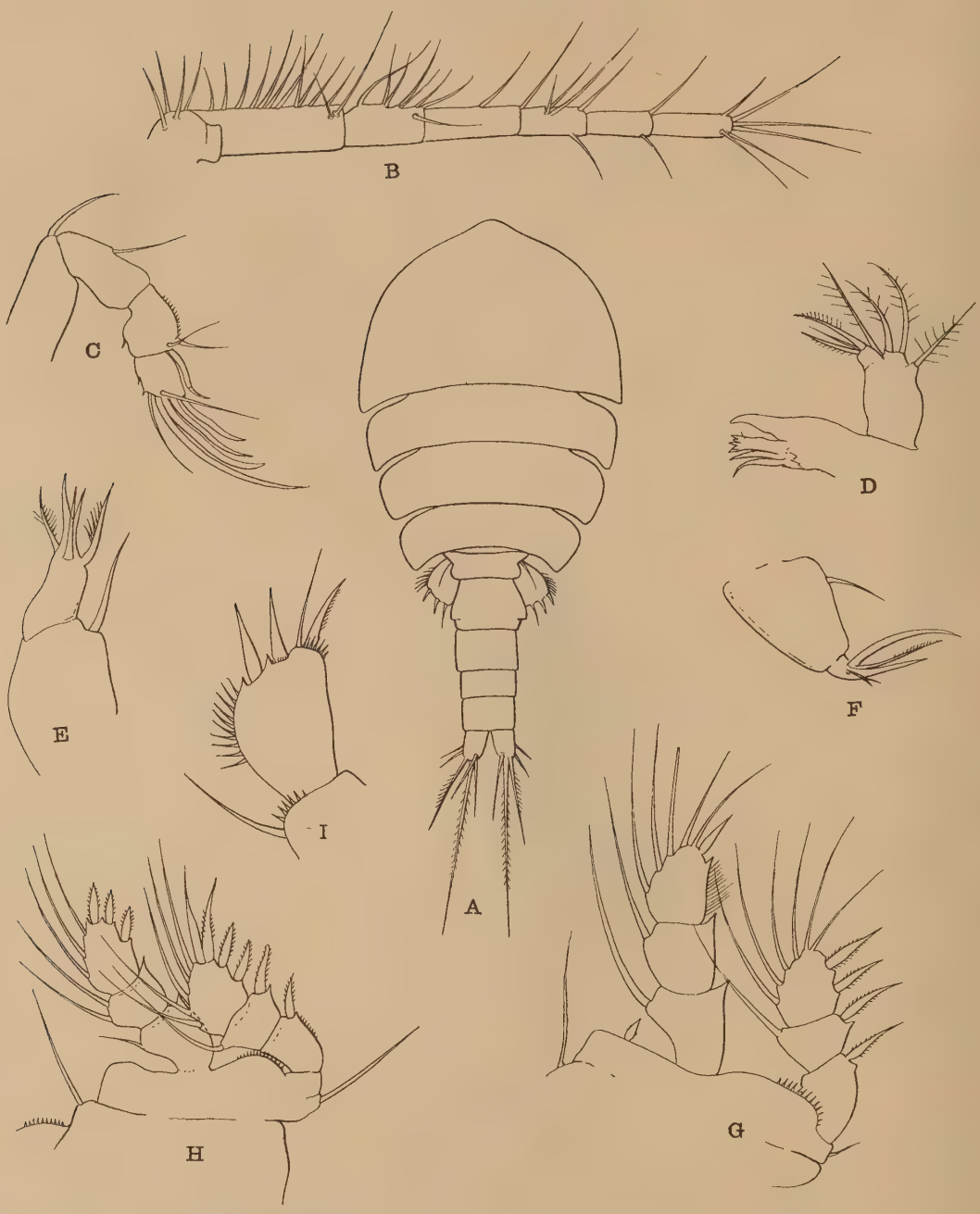
The proportional lengths of the anterior and posterior regions of the body (Text-fig. 16, A) are as 63 to 37. The anterior region is somewhat flattened and is broad. The anterior margin is produced in a low rounded prominence. The head and 1st thoracic segment are fused and the length of the combined mass is less than that of the three following segments. The abdomen is composed of only four segments. The proportional lengths of the segments of the posterior region of the body are as follows:

Th. 5.	Abd. 1.	2.	3.	4–5.	Furca.
15	23	20	14	17	11 = 100

The genital segment is only very slightly wider and but little longer than the posterior abdominal segments; and it is possible that the specimens are not fully mature. Segments 4 and 5 have apparently not yet separated. The furcal rami are short, being but little longer than broad. The arrangement of the furcal setæ is identical with that found in *Hemicyclops purpureus* Brady.

The 1st antenna (Text-fig. 16, B) consists of seven segments, the 1st of which is sharply bent. Segments 3 and 4 are only partially separate. The proportional lengths of the segments are as follows:

Segment 1.	2.	3.	4.	5.	6.	7.
11	26	13	17	11	11	11 = 100



TEXT-FIG. 16.—*Hemicyclops indicus* sp. nov., ♀. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, Mandible and 1st maxilla. E, 2nd maxilla. F, Maxilliped. G, 1st swimming leg. H, 2nd swimming leg. I, 5th leg.

The 2nd antenna (Text-fig. 16, C) is composed of four segments, of which the distal is the shortest, but only a little shorter than the 3rd. The 3rd segment bears two spines at the distal end, one straight and the other presenting a sigmoid curve ; a row of minute spinules extends along the anterior margin and a single spicule of somewhat larger size

projects from the posterior margin. The terminal segment bears four curved spines and two delicate seta at the distal end : these spines are shorter and stouter than in *H. aberdonensis* (T. Scott) and *H. purpureus* Boeck. Two small spinules project from the posterior margin.

The distal end of the mandible (Text-fig. 16, D) is armed with two tooth-like processes, one simple and conical and the other with a toothed distal end, and two setæ.

The 1st maxilla (Text-fig. 16, D) is stout and broad ; the main part bears four setæ at the distal outer angle : the distal inner portion of the appendage appears to be partially separated off as a small second segment. This latter region bears three setæ.

The 2nd maxilla (Text-fig. 16, E) apparently had only a single seta on the basal portion, instead of the usual two. The distal portion is armed with a Y-shaped spine, a single simple spine and two setæ, as in *H. purpureus* Brady. T. Scott (1892*c*) in his account of *Lichomolgus littoralis* has confused the mandible and the 2nd maxilla.

The maxilliped (Text-fig. 16, F) resembles that of *H. purpureus* Boeck.

In the first three pairs of swimming legs in this species, as in other members of the genus, the rami are rather short and broad. In the 1st leg (Text-fig. 16, G) basal 1 bears a slender seta on its inner margin : basal 2 bears a single small seta on its outer margin and internally is armed with a short stout spine that is shorter and stouter than that possessed by *H. purpureus* Boeck and very much shorter than that of *H. aberdonensis* (T. Scott). The line of attachment of the exopod is armed with a row of minute needle-like spinules. Exopod 1 bears a single marginal spine, but has no seta on its inner border. Exopod 2 has both a marginal spine and a seta. Exopod 3 possesses two marginal spines only, and there are six setæ on the inner margin and distal border. In the endopod the first two segments each bear a single inner seta and the 3rd segment has a spine at the distal outer angle and 5 setæ on the inner and distal margins.

In the 2nd leg (Text-fig. 16, H) basal 2 has no inner spine, but as in the 1st leg is armed along the line of attachment of the exopod with a row of small spinules. Exopod 3 bears three marginal spines and an end-spine, and of the series the two distal spines are produced in a delicate lash-like flagellum. There are five setæ on the inner and distal borders. The terminal segment of the endopod is armed with three serrated spines of approximately equal length and bears three setæ on the inner border. The 2nd segment possesses two inner setæ. The whole endopod is shorter and stouter than in *H. purpureus* Boeck.

Of the 5th pair of legs (Text-fig. 16, I) each consists of a basal portion and a single free segment. The basal part bears a single seta externally and is armed at the distal external angle with a row of spinules. The free segment is paddle-shaped, being broad and comparatively short, broader and shorter than in *H. purpureus* Boeck and *H. aberdonensis* (T. Scott) : it bears three stout spines along its distal margin and between the 2nd and 3rd spines is a delicate seta. The external margin and distal inner angle are armed with rows of needle-like spinules.

Associated with these females was a male, that I believe to belong to the same species.

♂. Total length 1·48 mm.

The proportional lengths of the anterior and posterior regions of the body are as 54 to 46. The segments of the abdomen are all separate and the proportional lengths of the segments of the posterior region are as follows :

Th. 5.	Abd. 1.	2.	3.	4.	5.	Furca.
13	23	18	15	11	9	11 = 100

In the 1st antenna the segments, of which there are seven, are all separate and they possess the following proportional lengths :

Segment 1.	2.	3.	4.	5.	6.	7.
13	27	9	19	11	11	10 = 100

Remarks.—This species comes very near to *Hemicyclops purpureus* Boeck, but it differs from that species in certain small details, such as the possession of an end-spine on the terminal segment of the exopod of the 2nd leg, instead of a seta, and three marginal spines instead of two on the 3rd segment of the exopod of the 4th leg.

Family Lichomolgidæ.

Subfamily Sabelliphilinæ Gurney.

Gurney, 1927, p. 463.

Included in this subfamily are those genera in which the endopod of the 4th leg is composed of three segments, namely :

Sabelliphilus M. Sars,
Rhinomolgus G. O. Sars,
Anthessius Della Valle (= *Pseudomolgus* G. O. Sars),
Herrmannella Canu (= *Pseudolichomolgus* Pesta),
Modiolichola Aurivillius,
Paranthessius Claus,
and *Pestalichomolgus* Wilson (= *Pseudolichomolgus* Pesta nom. preocc.).

A study of the setal formulæ of the swimming legs of these genera shows that there has been a progressive reduction in the number of spines and setæ arising from the posterior pairs of limbs in the female. The most complete formula is to be found in the genus *Rhinomolgus* G. O. Sars, as follows :

	Endopod.			Exopod.					
	1.	2.	3.	1.	2.		3.		
	Si.	Si.	Si. Se.	Si. Se.	Si. Se.		Si.	St.	Se.
P1	1	1	5, I	0 I	1 I		4	I	III
P2	1	2	3, III	0 I	1 I		5	I	III
P3	1	2	2, IV	0 I	1 I		5	I	III
P4	1	2	V	0 I	1 I		5	I	III

In the above formula I have given the setæ and spines on the three segments of the exopod on the inner and outer sides of the limb separately and I have denoted setæ by Arabic numerals and the spines by Roman numerals.

The first stage in the reduction is found in the genus *Anthessius* Della Valle : as Monod and Dollfus (1932) have pointed out this genus is synonymous with *Pseudomolgus* G. O. Sars and, having been created in 1880, has priority over Sars' name. In this genus there are slight differences from the typical formula in the 4th leg : one spine on the terminal

segment of the endopod has been replaced by a seta, and in some species there are only two external marginal spines, instead of three, on the last segment of the exopod. The setal formula thus becomes

	Endopod.			Exopod.			
	1.	2.	3.	1.	2.	3.	
	Si.	Si.	Si. Se.	Si. Se.	Si. Se.	Si. St.	Se.
P1 to P3				As above.			
P4	1	2	1, IV	0 I	1 I	5 I	II or III

The next stage in reduction is probably to be found in the genus *Paranthessius* Claus. Monod and Dollfus (1932, p. 143) have put forward the view that *Herrmannella* Canu and *Pseudolichomolgus* Pesta are synonyms of *Paranthessius*, but I entirely dissent from this view. I agree that *Herrmannella* and *Pseudolichomolgus* are synonymous, the name *Herrmannella* having priority, but the setal formula for *Paranthessius*, so far as we know it, is quite different. Unfortunately Claus (1889, p. 16) gives no account of the swimming legs of his species, *P. anemoniæ*, but he figures the endopod of the 4th leg as having two setæ on the 2nd segment and 3 spines on the 3rd segment of the endopod. The only other recorded species that possesses this arrangement is the species described by Sars (1921, p. 110, pl. lxxiii, fig. i) by the name *Herrmannella dubia*. *Herrmannella dubia* Sars and *Paranthessius anemoniæ* Claus possess other points of resemblance : Claus (1889, p. 17) states that in *P. anemoniæ* the 1st antenna has seven segments, but " sehr kurzen nur undeutlich abgegrenzten dritten Gliede." He suggests that the form described by Brady (1880, p. 49, pl. lxxxviii, figs. 10–14) under the name *Lichomolgus furcillatus* Thorell is not that species but may belong to the genus *Paranthessius*, and Brady specifically states that in this form the 1st antenna is composed of 6 segments, which thus agrees exactly with the condition present in *Herrmannella dubia* Sars. Claus also notes the great similarity in the character of the 2nd maxilla of these two forms and it seems probable that they are both members of the genus *Paranthessius* and may even be the same species, though, as in each case the description and figures are insufficient, it is impossible to decide this last point. It thus seems possible that the genus actually contains three species or forms, namely *Paranthessius anemoniæ* Claus, *Lichomolgus furcillatus* Brady (*non* Thorell) and *Herrmannella dubia* G. O. Sars, in which event the setal formula for the genus will be as follows :

	Endopod.			Exopod.			
	1.	2.	3.	1.	2.	3.	
	Si.	Si.	Si. Se.	Si. Se.	Si. Se.	Si. St.	Se.
P1	1	1	5, I	0 I	1 I	4 I	III
P2				Not given.			
P3	1	2	2, III	0 I	1 I	5 I	II
P4	1	2	III	0 I or 0	1 I or 0	5 I	II or I

The species that has been described by Nicholls (1944, p. 53, figs. 23–24) under the name *Paranthessius propinquus* has a setal formula that differs entirely from the above. A comparison of the mandible in this species with those in *Paranthessius anemoniæ* Claus

and *Herrmannella dubia* Sars shows that it is of a different type ; it terminates bluntly, whereas in the other two species it possesses a long delicate flagellum. Unfortunately Nicholls does not in his setal formula differentiate between spines and setæ, but it appears probable that the formula is as follows :

	Endopod.				Exopod.						
	1.	2.	3.		1.		2.		3.		
	Si.	Si.	Si.	Se.	Si.	Se.	Si.	Se.	Si.	St.	Se.
P1	1	1	5, I		0	I	1	I	4	I	III
P2	1	2	3, III		0	1	1	I	5	I	III
P3	1	1	2, IV		0	I	1	I	5	I	III
P4	1	1	1, IV or V		0	I	1	I	5	I	II

If this be so, it differs from the typical formula of the genus *Rhinomolgus*, by the loss of one seta on the 2nd segment of the endopod of the 3rd and 4th legs and by the conversion of the innermost spine on the terminal segment of the endopod of the 4th leg into a seta, with the loss of one of the marginal spines on the last segment of the exopod of that leg. It seems probable that a new genus will have to be created to accommodate this species.

Another stage in the process of reduction is to be found in a group of species that have hitherto been referred to the genus *Herrmannella* ; here the formula is as follows :

	Endopod.				Exopod.						
	1.	2.	3.		1.		2.		3.		
	Si.	Si.	Si.	Se.	Si.	Se.	Si.	Se.	Si.	St.	Se.
P1	1	1	5, I		0	I	1	I	4	I	III
P2	1	2	3, III		0	I	1	I	5	I	III
P3	1	2	2, IV		0	I	1	I	5	I	III
P4	1	1	V		0	I	1	I	5	I	II

The formula thus differs from that of *Rhinomolgus* by the loss of one seta on the second segment of the endopod of the 4th leg and of a marginal spine on the last segment of the exopod of that leg. The species that possess this formula are *Herrmannella finmarchica* T. Scott, *H. prehensilis* Sars and *H. tenuicauda* Sars, and it seems probable that with these should be grouped two species recorded from the Ceylon Pearl Banks, namely *Herrmannella robusta* and *H. serendibica*, both of Thompson and A. Scott (1903, p. 282). Unfortunately these authors have not given any account of the swimming legs in these two species, except that both branches of the 1st to 4th swimming legs are three-jointed. They figure the 1st and 4th legs in *H. robusta* and although they show only four spines on the terminal segment of the endopod of the 4th leg, they show a well-developed notch in the outer margin, and it seems probable that the 5th spine arose from this notch but was lost during dissection. To this group must be ascribed three new species that are present in the " Investigator " collections (*vide infra*, p. 81).

The next stage in the reduction of the armature of the limbs is met with, not in other species of the genus *Herrmannella*, but in the genus *Modiolicola* Auriv., in which the

number of spines arising from the distal joint of the endopod of the 4th leg is reduced from V to II, the formula for this leg thus becoming

P4 . 1 . 1 . II . 0 I . 1 I . 5 I II

A further reduction in the number of spines arising from the terminal segment of the endopod of the 3rd leg from IV to III gives us the formula

	Endopod.			Exopod.								
	1.	2.	3.	1.		2.		3.		
	Si.	Si.	Si. Se.	Si.	Se.	Si.	Se.	Si.	St.	Se.
P1	1	1	5, I	0	I	1	I	4	I	III
P2	1	2	3, III	0	I	1	I	5	I	III
P3	1	2	2, III	0	I	1	I	5	I	III
P4	1	1	II	0	I	1	I	5	I	II

This is the formula found in the genus *Sabelliphilus* M. Sars and also in certain species that have been included in the genus *Herrmannella* Canu and in Pesta's genus *Pseudolichomolgus*. I have already mentioned that Monod and Dollfus (1932) consider that *Herrmannella* and *Pseudomolgus* are synonyms. The genus *Herrmannella* was created by Canu to accommodate the species *H. rostrata*, which is the type of the genus, and in this group we must include *H. maxima* (Thompson), *H. parva* Norman and T. Scott and *H. valida* Sars, as well as *H. pectinis* (Pesta) (= *Pseudolichomolgus pectinis* Pesta): and it is these species and these only that in my opinion should be referred to the genus *Herrmannella* Canu (*sensu stricto*).

The genus *Lichomolgidium* Kossmann (1877, p. 19) appears to come very near to *Herrmannella* (*sensu stricto*): the swimming legs have the same setal formula except that the last segment of the exopod of the 4th leg possesses three marginal spines, instead of only two.

Genus *Sabelliphilus* M. Sars.

Sabelliphilus, G. O. Sars, 1913–18, p. 187.

Up to the present time no species belonging to this genus has been discovered in either the "Investigator" or the "John Murray" collections: that the genus does occur in Indian waters is indicated by the fact that Kossmann (1877, p. 16) has recorded *Sabelliphilus sarsi* Claparede from the Red Sea. Kossmann also described a second species that he attributed to this genus, namely *Sabelliphilus leuckarti*. Thompson (1893, p. 210) has admitted that the form described by him originally under the name *Lichomolgus sabellæ* is synonymous with *Sabelliphilus sarsi* Claparede. Sars (1913–18, p. 188) claims that all three species are synonyms of the species *Sabelliphilus elongatus* M. Sars; but Claus (1889, p. 15) expressed the opinion that *S. leuckarti* Kossmann is not a *Sabelliphilus* at all and is probably a species of *Lichomolgus*. Kossmann (1877, pl. ii) has figured the 2nd and 4th legs of this species and he shows that the endopod of the 4th leg is composed of only two segments which excludes the species from the subgenus Sabelliphilinæ and places it in the Lichomolginæ.

Genus *Anthessius* Della Valle.

Anthessius, Claus, 1889, p. 15 ; Monod and Dollfus 1932, p. 148.
Pseudomolgus, Sars, 1913–18, p. 181.

As Monod and Dollfus (1932) have pointed out, the genus *Pseudomolgus* Sars is a synonym of *Anthessius* Della Valle. Claus (1889) in his account of the genus recognized that the species described by Brady (1880, p. 46, pl. lxxxvi, figs. 1–7) under the name *Lichomolgus arenicolus* is an *Anthessius* and this was accepted by Canu (1894). Sars in 1916 erected the genus *Pseudomolgus* and in a later work (1913–18, p. 181) in his account of this genus established *Lichomolgus arenicolus* Brady as the type and included two other species, *leptostylis* and *dilatatus*. Hansen (1923, p. 19, pl. ii, figs. 7*a–g*) described another species, *Pseudomolgus grœnlandicus*, from West Greenland and Wilson (1921, p. 13, pl. iv, figs. 35–38, pl. v, figs. 44–48 and pl. vi, figs. 49–57) described *Pseudomolgus hawaiensis* from the Pacific Ocean.

The setal formula for this genus is as follows :

	Endopod.			Exopod.						
	1.	2.	3.	1.		2.		3.		
	Si.	Si.	Si. Se.	Si.	Se.	Si.	Se.	Si.	St.	Se.
P1	1	1	5, I	0	I	1	I	4	I	III
P2	1	2	3, III	0	I	1	I	5	I	III
P3	1	2	2, IV	0	I	1	I	5	I	III
P4	1	2	1, IV	0	I	1	I	5	I	II or III

The figure which Brady (1880, pl. lxxxvii, fig. 6) gives of one of the thoracic appendages of *Lichomolgus arenicola* is labelled " Foot of first pair " but this is clearly an error since the 2nd segment of the endopod bears two setae and the third segment one seta and four spines : it is the 4th foot and it shows that the terminal segment of the exopod is possessed of three marginal spines. *Anthessius arenicolus* (Brady) has been recorded from the washings of Invertebrates taken off the Ceylon coast by Thompson and A. Scott (1903) under the name *Herrmannella arenicola*. The species recorded from the Malay Archipelago by A. Scott (1909) under the name *Herrmannella concinna* must, as Monod and Dollfus (1932, p. 139) have pointed out, be removed to the present genus, and like *arenicola* it has three marginal spines on the exopod of the 4th leg.

Similarly three such marginal spines on the 3rd segment of the 4th exopod are present in Hansen's *grœnlandicus*, and also in *hawaiensis* Wilson. In *leptostylis* Sars and *dilatatus* Sars there are only two marginal spines on the 3rd segment of the exopod of the 4th leg.

The present collections contain two species that must be referred to this genus, both of them apparently new : of these, one, *brevifurca* sp. nov., has three marginal spines on the 3rd segment of the exopod of the 4th leg, and the other, *investigatoris* sp. nov., has two only.

Anthessius brevifurca sp. nov. (Text-fig. 17, A–K.)

Occurrence.—Addu Atoll, Maldive Archipelago : in weed washings. One female.

Descriptive Notes.—♀. Total length 1·80 mm.

The proportional lengths of the anterior and posterior regions of the body (Text-fig. 17, A) are as 62 to 38. The anterior region forms a wide oval, being considerably broader

TEXT-FIG. 17.—*Anthessius brevifurca* sp. nov., ♀. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, Mandible and 1st maxilla. E, 2nd maxilla. F, Maxilliped. G, 1st swimming leg. H, 2nd swimming leg. I, Endopod of 3rd swimming leg. J, 4th swimming leg. K, 5th leg.

than in *A. arenicola* (Brady) or either of the two species described by Sars, *A. leptostylis* and *A. dilatatus*. The head and 1st thoracic segment are clearly demarcated from each other. The lateral margins of the posterior thoracic segments are rounded. The posterior region is more robust than in other species of the genus ; the proportional lengths of the segments of this region are as follows :

Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
30	29	14	11	9	7 = 100

The genital segment is dilated in its anterior half, the greatest breadth being approximately equal to the length of the whole segment. The furcal rami are relatively short, being less than the length of the anal segment and but little longer than wide. In this respect this species differs from all the other known members of the genus, for in *A. arenicola* (Brady) they are about three times as long as wide and in the other two species, *leptostylis* (Sars) and *dilatatus* (Sars), they are still longer.

The 1st antenna (Text-fig. 17, B) is of moderate length and reaches back to about two-thirds the length of the head : the 6th and 7th segments are partly fused, so that there are only six free segments in the appendage. The proportional lengths of the segments are as follows :

Segment 1.	2.	3.	4.	5.	6-7.
12	26	7	24	19	12 = 100 (8 + 4)

The 2nd antenna (Text-fig. 17, C) consists of only three segments, of which the 1st or basal is the longest and the other two of approximately equal length : the distal segment differs from those of other species in the genus in that it bears distally a series of six setæ or seta-like spines instead of two setæ and four geniculate spines.

The mandible and 1st maxilla (Text-fig. 17, D) agree very closely with the corresponding appendages in *A. arenicola* (Brady).

The 2nd maxilla (Text-fig. 17, E) consists of two segments, of which the basal is large and powerful : the distal segment bears only five spines on its distal margin, as in *A. leptostylis* Sars, instead of six, as in *A. arenicola* (Brady), *A. dilatatus* Sars and *A. grœnlandicus* Hansen, or eleven as in *A. concinna* (A. Scott).

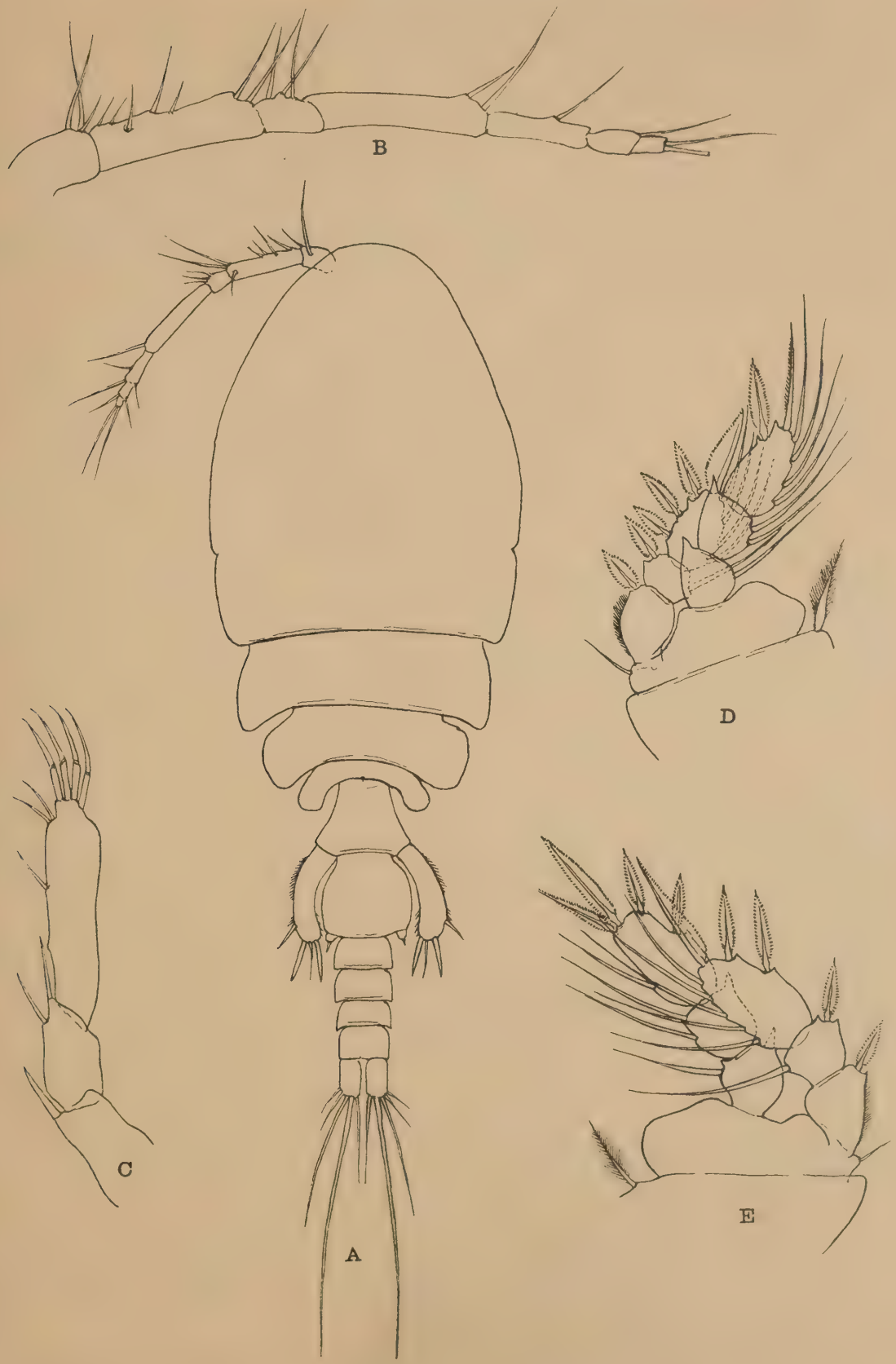
The maxilliped (Text-fig. 17, F) is greatly reduced and resembles that of the other females of the genus.

In the swimming legs both exopod and endopod are composed of three segments and the setal formula for the species is as follows :

	Endopod.					Exopod.							
	1.	2.	3.			1.		2.		3.			
	Si.	Si.	Si.	Se.		Si.	Se.	Si.	Se.	Si.	St.	Se.	
P1	1	1	5,	I		0	I	1	I	4	I	III	
P2	1	2	3,	III		0	I	1	I	5	I	III	
P3	1	2	2,	IV		0	I	1	I	5	I	III	
P4	1	2	1,	IV		0	I	1	I	5	I	III	

In the 4th leg (Text-fig. 17, J) the 3rd segment of the exopod carries three marginal spines and an end-spine, so that this species resembles *A. arenicola* (Brady) and *A. grœnlandicus* (Hansen) and differs from *A. leptostylis* (Sars) and *A. dilatatus* (Sars).

The 5th leg (Text-fig. 19, K) is clavate and is well developed, reaching back almost to the posterior margin of the genital segment : it bears on its free segment three spines and one seta, one spine on the outer margin at about the junction of the middle and distal thirds, and two unequal spines, separated by a seta, on the distal margin. The segment is fringed with small spinules along the outer margin as far as the origin of the outer spine and along the distal two-thirds of the inner border.



TEXT-FIG. 18.—*Anthessius investigatoris* sp. nov., ♂. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, 1st swimming leg. E, 2nd swimming leg.

Anthessius investigatoris sp. nov. (Text-fig. 18, A–E.)

Occurrence.—" Investigator " Station 664, Henry Lawrence Island, Andaman Islands ; in weed-washings. One male.

Descriptive Notes.—♂. Total length 1·13 mm.

The proportional lengths of the anterior and posterior regions of the body (Text-fig. 18, A) are as 61 to 39. The anterior region possesses an elongate oval outline, with the widest part at about the level of the posterior margin of the cephalon. The cephalon is partly fused with the 1st thoracic segment, but the line of fusion is indicated in the lateral region by a shallow notch in the border. The proportional lengths of the segments of the posterior region are as follows :

Th. 5.	Abd. 1.	2.	3.	4.	5.	Furca.
20	25	13	10	8	11	13 = 100

The genital segment is about as broad as long : at the postero-lateral angles it is produced in a mammilliform prominence, that bears a small spine. The furcal rami are slightly longer than the anal segment and are about one and a half times as long as broad.

The 1st antenna (Text-fig. 18, B) reaches back about half-way to the posterior margin of the fused cephalon and 1st thoracic segment. Sars (1913–18, p. 181) in his description of the genus *Pseudomolgus* remarks that this appendage is " generally composed of 7 articulations clothed with comparatively short setæ " ; both Brady and T. Scott have pointed out that in *A. arenicola* (Brady) the 1st antenna possesses only six segments, but Sars in his account of the specimen taken by him on the Norwegian coast claims that the appendage had 7 segments, " the somewhat oblique suture between the last two joints being distinctly marked." The present specimen clearly exhibits a partial fusion of the two terminal segments. The proportional lengths of the segments are as follows :

Segment 1.	2.	3.	4.	5.	6–7.
12	25	7	30	15	11 = 100

The 2nd antenna (Text-fig. 18, C) is composed to three segments, of which the 3rd is about equal in length to the preceding two : at its distal end this segment bears the usual four geniculate spines and two setæ.

In the 1st leg (Text-fig. 18, D) the exopod and endopod are of about equal length. The 2nd segment of the endopod bears two setæ instead of the usual one, and the terminal segment bears on the outer margin a well-developed spine that is of about the same length as the segment itself, and on the distal margin next to it is a seta that is thicker and more spine-like than the remaining four setæ that arise from the inner margin.

In the 4th leg (Text-fig. 18, E) the terminal segment of the exopod is armed with only two marginal spines, thus resembling *A. leptostylis* (Sars) and *A. dilatatus* (Sars) and differing from *A. arenicola* (Brady), in which there are three spines on this margin.

The 5th leg is clavate and bears a comparatively delicate spine about three-quarters of the length along the outer margin, while at the distal end arise two equal spines separated by a single seta. The outer margin of the free segment is fringed with small spinules in its proximal half, and a series of needle-like spines fringe the inner margin in the distal third of its length.

Remarks.—From its general shape and size and the shortness of the furcal rami this specimen might well be the male of the previously described female, but in view of the fact that the male possesses only two marginal spines on the terminal segment of the

exopod of the 4th leg, whereas the female possesses three, and also in consideration of the great distance that separates the two captures, I think it is advisable for the present to treat them as distinct species.

Genus *Herrmannella* Canu (= *Pseudolichomolgus* Pesta).

Hermannella, Canu, 1891, p. 479 ; Sars, 1913–18, p. 174.

As Monod and Dollfus (1932, p. 131) have pointed out, the correct spelling of the name of this genus is as given above. A number of species have been referred to this genus, namely :

Herrmannella rostrata Canu (= *Lichomolgus agilis* T. Scott, *non* Leydig), the type of the genus,
H. maxima Thompson,
H. parva Norman and T. Scott,
H. pectinis (Pesta) (= *Pseudolichomolgus pectinis* Pesta),
H. finmarchica T. Scott,
H. prehensilis Sars,
H. tenuicaudis Sars,
H. robusta Thompson and A. Scott,
H. serendibica Thompson and A. Scott,
H. dubia Sars,
H. valida Sars,

and among the present collections are three further species that must be grouped with the above, and for these I am proposing the names *Herrmannella brevicauda* sp. nov., *H. nicobarica* sp. nov., and *H. adduensis* sp. nov. Monod and Dollfus (1932, p. 139) have also pointed out that the species from the Malay Archipelago described by A. Scott (1909, p. 262, pl. lxviii, figs. 1–10) under the name *Herrmannella concinna* is not a member of this genus at all, but is an *Anthessius*.

As I have mentioned above (*vide supra*, p. 74) a study of the setal formula of these species reveals that, with the single exception of *Herrmannella dubia* Sars, that probably belongs to the genus *Paranthessius* Claus, they fall into two groups, characterized by possessing different formulæ for the 3rd and 4th swimming legs.

In one of these groups the setal formula for the endopod of the 4th swimming leg is 1, 1, II, the terminal segment bearing only two spines. This is the condition present in *Herrmannella rostrata* Canu, the type of the genus and it is also found in *H. maxima* (Thompson), *H. parva* Norman and T. Scott, *H. pectinis* (Pesta) and *H. valida* Sars.

I am of the opinion that it is only these species that should be referred to the genus *Herrmannella* (*sensu stricto*). The full setal formula for the genus, as I propose to restrict it, is as follows :

	Endopod.			Exopod.								
	1.	2.	3.	1.		2.		3.		
	Si.	Si.	Si. Se.	Si.	Se.	Si.	Se.	Si.	St.	Se.
P1	1	1	5, I	0	I	1	I	4	I	III
P2	1	2	3, III	0	I	1	I	5	I	III
P3	1	2	2, III	0	I	1	I	5	I	III
P4	1	1	II	0	I	1	I	5	I	II

Sars (1913–18, p. 175) has pointed out that the 2nd antenna exhibits differences in certain species: in some, namely *Herrmannella rostrata* Canu, *H. maxima* (Thompson) and *H. valida* Sars, this appendage is strongly prehensile and is armed in *H. rostrata* and *H. valida* with a strong claw and in *H. maxima* with two strong claws that are situated at the distal end of the terminal segment; in *H. parva* Norman and T. Scott, however, this appendage is hardly, if at all, prehensile and has an "Unguiform spine accompanied in front by 2 short setæ" on the 3rd segment and "3 subequal almost setiform claws, behind which 3 setæ are attached on the 4th or terminal segment."

In the 2nd group of species the setal formula for the legs is as follows:

	Endopod.					Exopod.							
	1.	2.	3.			1.		2.		3.		
	Si.	Si.	Si.	Se.		Si.	Se.	Si.	Se.	Si.	St.	Se.
P1	1	1	5, I			0	I	1	I	4	I	III
P2	1	2	3, III			0	I	1	I	5	I	III
P3	1	2	2, IV			0	I	1	I	5	I	III
P4	1	1	V			0	I	1	I	5	I	II

In this group I include *prehensilis* Sars, *robusta* Thompson and A. Scott, *serendibica* Thompson and A. Scott and two new species *nicobarica* sp. nov., and *adduensis* sp. nov., in all of which the 2nd antenna is prehensile in character, and *finmarchica* T. Scott, *tenuicaudis* Sars and *brevicauda* sp. nov., in which the 2nd antenna is non-prehensile. In the non-prehensile type of 2nd antenna the structure closely resembles that in the species of the genus *Herrmannella* (*sensu stricto*), namely *H. parva* Norman and T. Scott, in which, too, the 2nd antenna is non-prehensile; at the distal anterior angle of the 3rd segment there are three setæ and a single setiform spine and from the distal end of the 4th segment arise three setiform spines and three setæ. But in the prehensile type this character has been brought about in a manner different from that in *Herrmannella*, for the prehensile claw arises, not from the 4th segment but from the 3rd, while the 4th segment is relatively small and bears from three to five short delicate setæ only. The prehensile character of this 2nd antenna in these two groups is therefore not evidence of relationship but of convergence. I propose to erect a new genus *Preherrmannella* to include these species.

Genus *Preherrmannella* gen. nov.

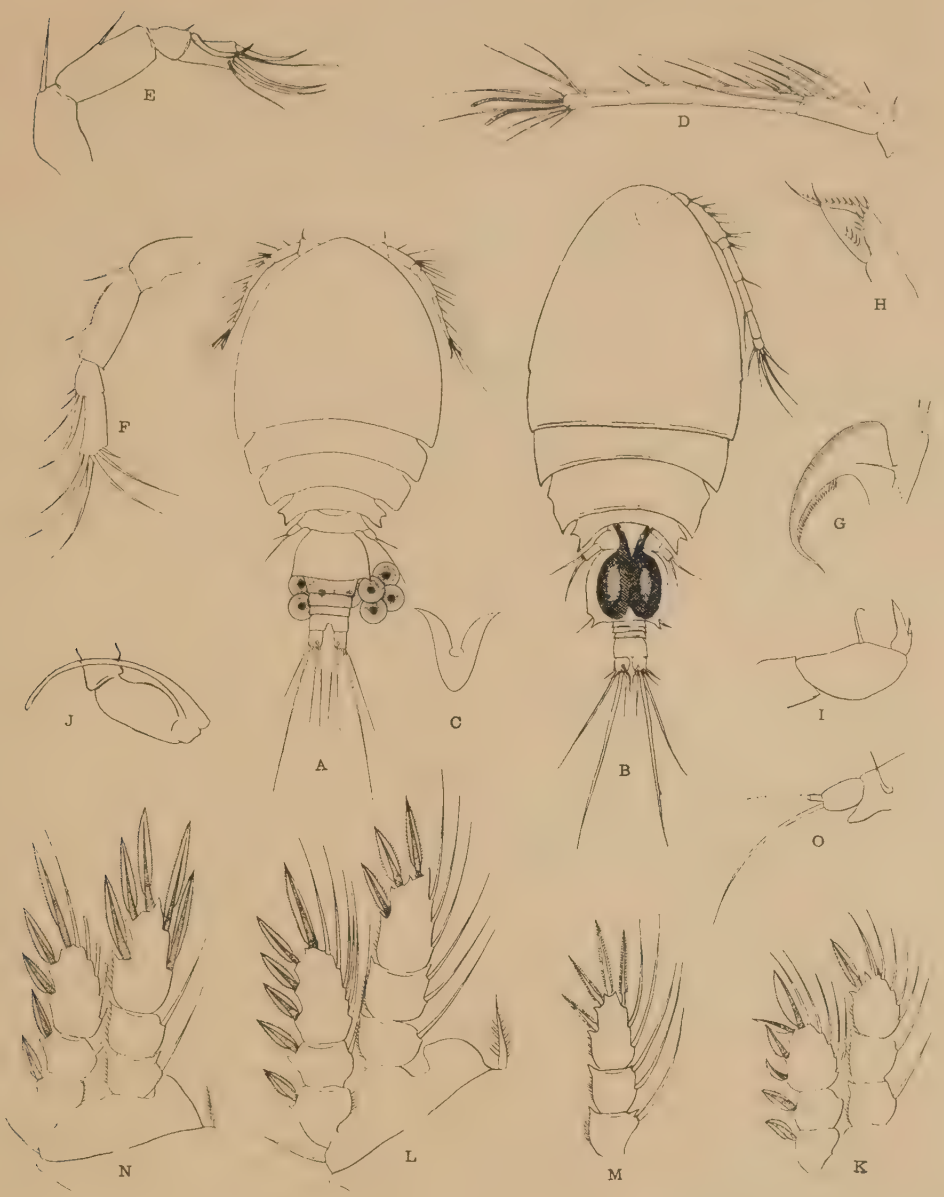
The species belonging to this genus possess two setæ and four spines on the terminal segment of the endopod of the 3rd leg and 5 spines on the terminal segment of the 4th leg. Where the 2nd antenna has attained a prehensile character this has been reached by the development of a stout claw on the 3rd segment.

In this genus I include *Preherrmannella prehensilis* (Sars), *robusta* (Thompson and A. Scott), *serendibica* (Thompson and A. Scott) and two new species *nicobarica* sp. nov. and *adduensis* sp. nov., all with a prehensile 2nd antenna, and *finmarchica* (T. Scott), *tenuicaudis* (Sars) and *brevicauda* sp. nov. with a non-prehensile 2nd antenna.

Preherrmannella brevicauda sp. nov. (Text-fig. 19, A–O.)

Occurrence.—Addu Atoll, Maldive Archipelago; in weed-washings. One female and one male.

Descriptive Notes.—♀. Total length 0·92 mm.



TEXT-FIG. 19.—*Preherrmannella brevicauda* sp. nov. A, Dorsal aspect, ♀. B, Dorsal aspect, ♂. C, Rostrum. D, 1st antenna, ♀. E, 2nd antenna, ♂. F, 2nd antenna, ♀. G, Mandible and 1st maxilla, ♀. H, 2nd maxilla, ♀. I, Maxilliped, ♀. J, Maxilliped, ♂. K, 1st swimming leg, ♀. L, 2nd swimming leg, ♀. M, Endopod of 3rd swimming leg, ♂. N, 4th swimming leg, ♀. O, 5th leg, ♀.

The proportional lengths of the anterior and posterior regions of the body are as 72 to 28. The anterior region forms a broad oval. The head and 1st thoracic segment (Text-fig. 19, A) are fused and their combined length is equal to twice that of the following three segments. The length and breadth of the cephalic segment are nearly equal. The 2nd, 3rd and 4th thoracic segments are expanded laterally and the margin of the 4th segment

is emarginate. The abdomen is short and broad ; the proportional lengths of the segments of the abdomen are as follows :

Abd. 1–2.	3.	4.	5.	Furca.
56	12	6	14	12 = 100

The genital segment is thus considerably longer than the whole of the rest of the abdomen ; it is dilated anteriorly and this dilated portion terminates at the postero-lateral angles in a sharp backwardly directed projection that bears a single delicate seta. The furcal rami are short, being but little longer than broad.

The specimen was carrying two egg-sacs, but both of these were somewhat damaged, only a few eggs remaining attached to the sides of the genital segment.

The rostrum (Text-fig. 19, C) forms a depressed triangular plate.

The 1st antenna (Text-fig. 19, D) reaches back to about two-thirds of the length of the cephalon : it is composed of seven segments, of which the 2nd and 4th are the longest and the 3rd is quite short. The proportional lengths of the segments are as follows :

Segment 1.	2.	3.	4.	5.	6.	7.
14	22	6	22	18	12	6 = 100

The terminal segment bears two sensory filaments of moderate length.

The 2nd antenna (Text-fig. 19, F) is well developed, but is non-prehensile in character, resembling that of *tenuicaudis* Sars.

The mandible and 1st maxilla (Text-fig. 19, G) resemble that of other members of the genus ; the masticatory plate of the mandible tapers to a fine setiform lash and is fringed along its outer edge with numerous delicate spines, while the crest-like inner margin is ribbed. The 1st maxilla bears one seta about half-way along its length and two setæ at the distal end.

The 2nd maxilla (Text-fig. 19, H) bears a well-developed spinose seta near the base and the terminal lash is armed with a row of spines ; it closely resembles the corresponding appendage in *Preherrmannella finmarchica* (T. Scott), as figured by T. Scott (1903*a*, pl., iv fig. 17).

The maxilliped (Text-fig. 19, I) is of the type found in other members of the genus. It consists of three segments, of which the 2nd is somewhat swollen and bears a single seta, and the 3rd is produced in a conical process that bears a short spine on its outer margin.

The swimming legs (Text-fig. 19, K, L and N) closely resemble those of *Preherrmannella finmarchica* T. Scott. As in all the species that I refer to this genus, the terminal segment of the endopod of the 3rd leg (Text-fig. 19, M) has two setæ and four spines, while that of the 4th leg possesses five spines.

The 5th leg (Text-fig. 19, O) consists of a basal segment that bears a single seta on its outer border and is produced in a bluntly rounded prominence ; the free segment is short and oval in shape and bears two setæ, of which the inner is about four times the length of the segment ; unfortunately the outer seta was broken off short.

♂. Total length 0·68 mm.

The proportional lengths of the anterior and posterior regions of the body are as 68 to 32. The anterior region (Text-fig. 19, B) is considerably less expanded than in the

female, the width being only about two-thirds the length. The line of fusion of the cephalon and 1st thoracic segment is indicated on the lateral border by a small notch, but I was unable to trace any line of demarcation across the dorsal aspect. The lateral border of the 3rd thoracic segment is slightly emarginate and the border of the 4th segment forms a well-marked notch. The segments of the posterior region of the body have the following proportional lengths :

Th. 5.	Abd. 1.	2.	3.	4.	5.	Furca.
11	51	6	6	6	11	9 = 100

The genital segment is much swollen and is of a sub-quadrangular shape. At the postero-lateral angles there is a small spinous projection, from the outer side of which a delicate seta arises. The next three segments are all sub-equal and were much telescoped. The anal segment is about twice the length of the preceding one. The furcal rami are about as long as broad.

The rostrum is a depressed triangular plate with the apex somewhat bluntly rounded.

The 1st antenna reaches back nearly to the notch that indicates the posterior limit of the cephalon. It consists of seven segments that have the following proportional lengths :

Segment 1.	2.	3.	4.	5.	6.	7.
12	24	5	21	19	12	7 = 100

The 2nd antenna (Text-fig. 19, E) can only be feebly prehensile. The 3rd segment bears a moderately strong curved claw-like spine that reaches beyond the tip of the terminal segment. The end segment is nearly one and a half times as long as the 3rd and is armed with three or four long curved spines.

The maxilliped (Text-fig. 19, J), as in all males of this and closely related genera, is modified into a grasping organ, the terminal segment or dactylus being about twice the length of the palm.

The legs resemble those of the female. In the 5th leg the two setæ that arise from the distal end of the free segment are subequal in length.

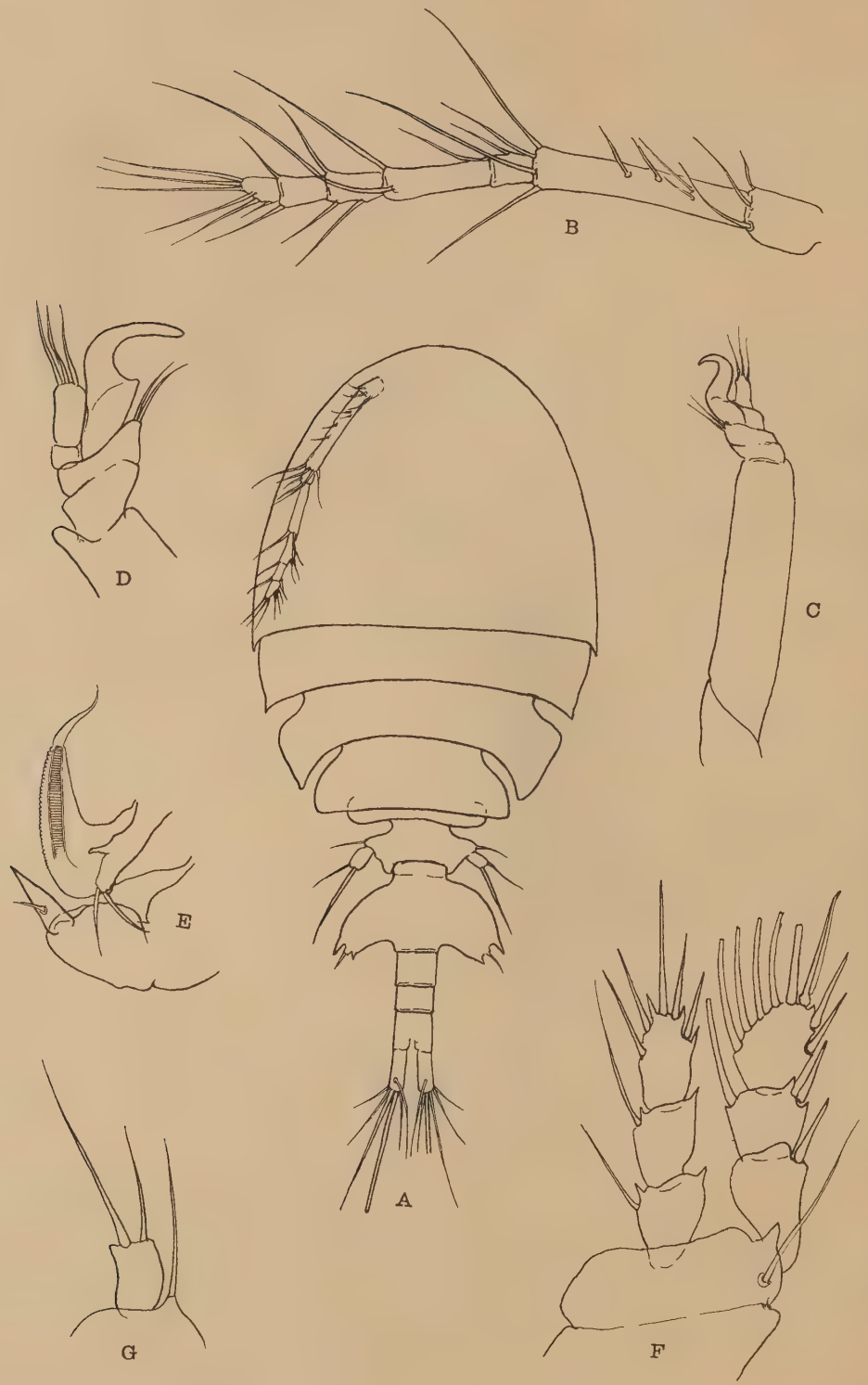
Preherrmannella adduensis sp. nov. (Text-fig. 20, A–G and Text-fig. 21, A–I.)

Occurrence.—Addu Atoll, Maldive Archipelago ; in weed-washings. One female and two males. Nankauri Harbour, Nicobar Islands ; in weed-washings. One female.

Descriptive Notes.—♀. Total length 1·30 mm.

The proportional lengths of the anterior and posterior regions of the body (Text-fig. 20, A) are as 60 to 40. The anterior region is broad, being about one and a third times as long as wide. The cephalon and 1st thoracic segment are only partially fused, the line of demarcation being clearly visible in the dorso-lateral region, terminating in a small notch on the lateral border. The 4th thoracic segment is more or less telescoped into the 3rd, so that in one specimen it was not visible from the dorsal aspect. The segments of the posterior region have the following proportional lengths :

Segment Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
19	31	13	9	12	16 = 100



TEXT-FIG. 20.—*Preherrmannella adduensis* sp. nov., ♀. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, Grasping end of 2nd antenna. E, Mouth-parts *in situ*. F, 4th swimming leg. G, 5th leg.

The genital segment is greatly expanded laterally and is produced outwards and backwards, so that the whole segment forms an arc of a circle. The postero-lateral border is produced in two spinous projections, of which the outer is the larger : between these arises a single delicate seta. One of the specimens was ovigerous, carrying a pair of egg-sacs, each containing about twelve ova. The posterior abdominal segments are narrow and the forcal rami are about one and a third times the length of the anal segment and nearly three times as long as broad.

I was unable to detect any rostrum.

The 1st antenna (Text-fig. 20, B) is composed of seven segments that have the following proportional lengths :

Segment 1.	2.	3.	4.	5.	6.	7.
14	39	9	17	8	7	6 = 100

The appendage reaches nearly to the posterior margin of the cephalon.

The 2nd antenna (Text-fig. 20, C and D) is strongly prehensile. The 2nd segment is long ; the 3rd is very short and appears to be partially subdivided ; the distal portion is somewhat produced distally and two small setæ arise from the apex of the projection ; the distal part also bears a stout curved claw. The terminal segment also appears to be partially subdivided into a short basal part and a distal part that is about twice as long and bears three setæ at the distal end.

The mouth-parts (Text-fig. 20, E) are of the type usual in the genus.

In the swimming legs both rami are composed of three segments. In the 3rd leg the terminal segment of the endopod bears two setæ and 4 spines ; and in the 4th leg (Text-fig. 20, F) it is armed with five spines.

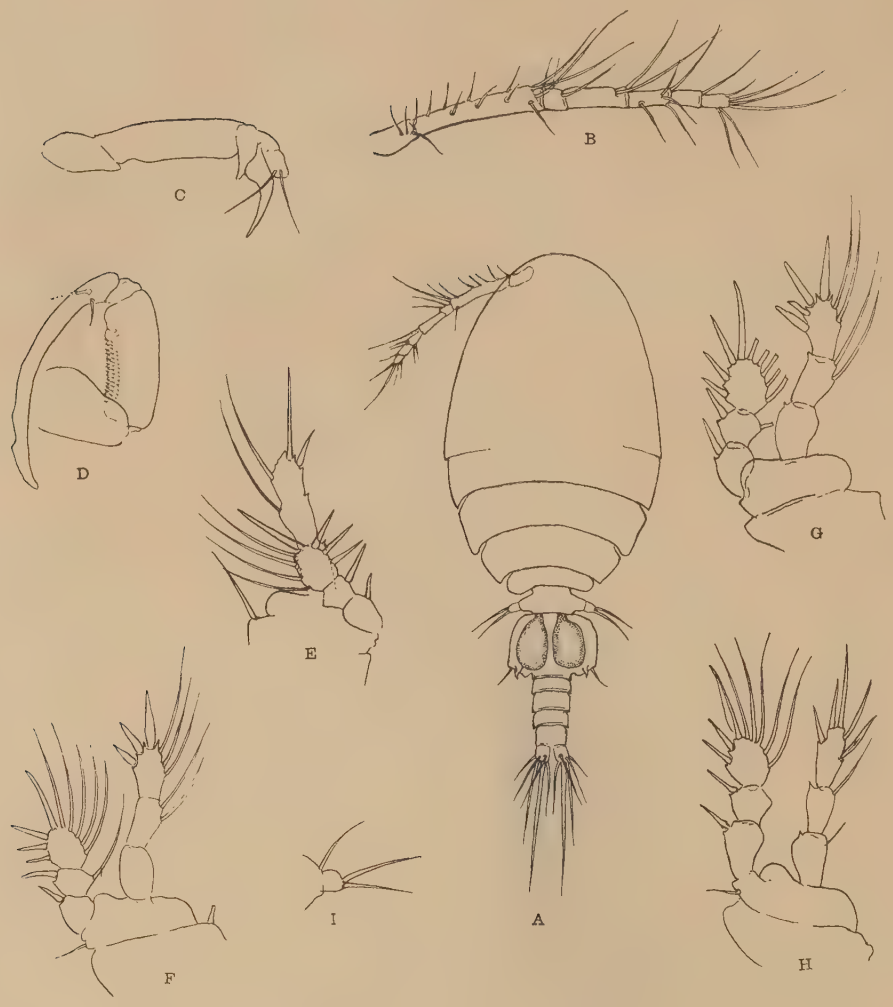
The 5th leg (Text-fig. 20, G) is small. The basal segment is fused with the rest of the thoracic segment and a seta arises close to the articulation of the free joint ; this latter bears two unequal setæ.

♂. Total length 0·68 to 0·76 mm., the difference depending on the degree of contraction of the abdomen. The proportional lengths of the anterior and posterior regions of the body (Text-fig. 21, A) are as 66 to 34, or 70 to 30 in the two specimens. The anterior region forms a moderately broad oval but is not so wide as in the female, the width being about two-thirds the length ; the width appears to differ somewhat in the two specimens, but this is probably due to compression in one of the examples. The proportional lengths of the segments of the posterior region are as follows :

Th. 5.	Abd. 1.	2.	3.	4.	5.	Furca.
10	40	9	11	9	11	10 = 100

The genital segment is dilated and is about as broad as long ; in the postero-lateral region there is a small spine, outside which arises a single delicate seta. In the contracted specimen segment 2 was completely telescoped into the genital segment and segments 3 and 4 were each much telescoped into the preceding segment. The furcal rami, unlike those of the female are short, being about as broad as long.

The 1st antenna (Text-fig. 21, B) is relatively short and reaches back only about



TEXT-FIG. 21.—*Preherrmannella adduensis* sp. nov., ♂. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, Maxilliped. E, 1st swimming leg. F, 2nd swimming leg. G, 3rd swimming leg. H, 4th swimming leg. I, 5th leg.

two-thirds the length of the cephalon. It consists of seven segments, having the following proportional lengths :

Segment 1.	2.	3.	4.	5.	6.	7.
14	36	7	17	10	8	7 = 100

The 2nd antenna (Text-fig. 21, C) and mouth-parts closely resemble those of the female, but the maxilliped (Text-fig. 21, D) is well developed and forms a grasping claw.

In the 1st pair of swimming legs (Text-fig. 21, E) in the specimen dissected the exopod is composed of the usual three segments, but the endopod consists of two joints only, the 2nd and 3rd segments being fused together, though a small notch in the outer margin indicates the line of fusion ; a single seta arises from the proximal part and the distal

portion bears two unequal spines near the distal outer angle and one seta on the inner border, but the absence of other setæ may be accidental.

In the 2nd pair (Text-fig. 21, F) the legs of the two sides differ. On one side the endopod possesses three segments, but the distal one is short, being only about half the length of the 2nd segment; it bears only a single spine at the distal outer angle. On the other side the 2nd and 3rd segments are partially fused, but the line of demarcation is clearly visible and the two portions bear the normal number of setæ and spines, namely, two setæ on the proximal part and three setæ and three spines on the distal. It is probable that these abnormalities are due to injury during life. In the 3rd leg (Text-fig. 21, G) both rami are three-jointed, but the endopod is considerably longer than the exopod. The terminal segment of the endopod bears two setæ and four spines, of which the 2nd is somewhat smaller than the others and is recurved and blunt at the tip. In the 4th leg (Text-fig. 21, H) the endopod is comparatively slender and the 3rd segment is armed with five spines.

The 5th leg (Text-fig. 21, I) is small. The basal joint is fused with the rest of the thoracic segment and a single seta arises near the articulation of the free segment, which bears two unequal setæ.

Preherrmannella nicobarica sp. nov. (Text-fig. 22, A–G.)

Occurrence.—Nankauri Harbour, Nicobar Islands; in weed-washings. One female.

Descriptive Notes.—♀. Total length, 1·1 mm.

The proportional lengths of the anterior and posterior regions of the body are as 65 to 35.

The anterior region (Text-fig. 22, A) is very broadly oval in shape; the head is very imperfectly separated off from the 1st thoracic segment, the line of demarcation being indicated only in the lateral region by a notch in the margin. The lateral margins of the free thoracic segments are rounded. The rostrum forms a depressed, wide, semicircular plate. The posterior region is of moderate length; the proportional lengths of the segments are as follows:

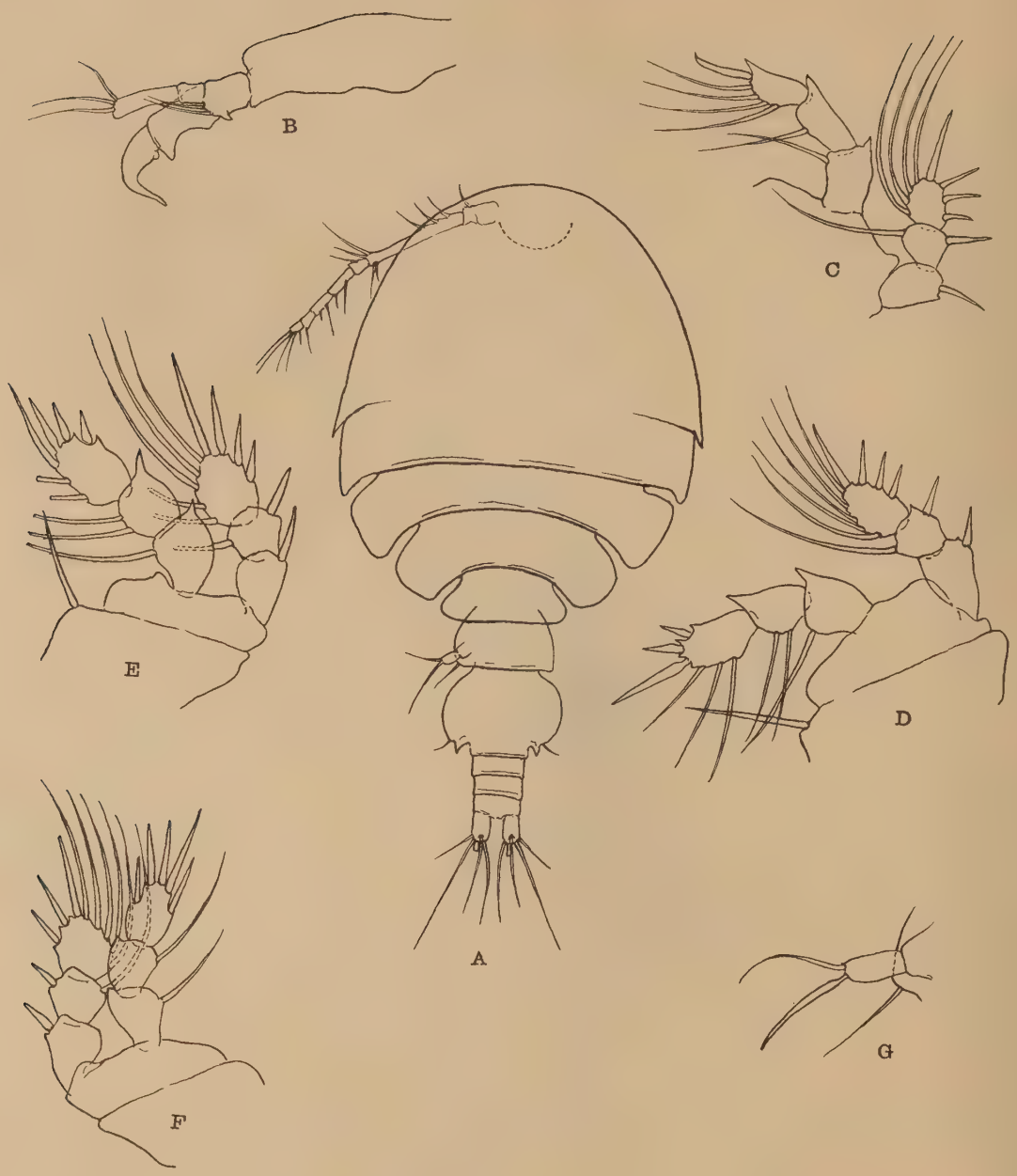
Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
28	32	10	9	10	11 = 100

The 5th thoracic segment is unusually large. The genital segment is swollen and is produced at the postero-lateral corners in a sharp-pointed process, on the outer side of which arises a small delicate seta. The furcal rami are about one and a half times as long as broad.

The 1st antenna reaches back almost to the posterior limit of the head region. The proportional lengths of the seven segments are as follows:

Segment 1.	2.	3.	4.	5.	6.	7.
15	41	6	14	12	7	5 = 100

The 2nd antenna (Text-fig. 22, B) is of the prehensile type and appears to be biramous: the 2nd segment is long and bears at its distal end a 3rd segment that is about one and a



TEXT-FIG. 22.—*Preherrmannella nicobarica* sp. nov., ♀. A, Dorsal aspect. B, 2nd antenna. C, 1st swimming leg. D, 2nd swimming leg. E, 3rd swimming leg. F, 4th swimming leg. G, 5th leg.

quarter times as long as broad and carries at its extremity a sharply-curved claw and two delicate setæ ; at the end of this segment there arises a short branch that is composed of two segments, the first small and the 2nd about twice the length of the first, and bearing at its distal end three setæ. I was unfortunately unable to examine the mouth-parts. The swimming legs (Text-fig. 22, C, D, E and F) exhibit the characters of the genus. In

all four pairs the endopod is considerably longer than the exopod. The number of spines and setæ present on the terminal segments of the endopods are as follows :

P1 . . .	1 spine and 4 (?) setæ.
P2 . . .	3 spines and 3 setæ.
P3 . . .	4 spines and 2 setæ.
P4 . . .	5 spines.

The 5th leg (Text-fig. 22, G) is composed of a basal part that is fused with the segment, and bears a single seta. The free segment is short and cylindrical and bears at its apex one curved spine-like seta and a more delicate normal seta.

Subfamily Lichomolginæ.

The classification of the species of this subfamily is a matter of extreme difficulty. From time to time a number of genera have been created, namely :

Doridicola Leydig	1853
Lichomolgus Thorell	1860
Sepicola Claus	1860
Eolidicola M. Sars	1862
Boeckia Brady	1872 (nom. preocc.)
Macrochiron Brady	1872
Stellicola Kossmann	1877
Lichomolgidium Kossmann	1877
Pseudanthessius Claus	1880
Linckiomolgus Stebbing	1900
Paralichomolgus Thompson and A. Scott .	1903
Heteranthessius T. Scott	1904
Lichomolgella G. O. Sars	1918
Kelleria Gurney	1927

Monod and Dollfus (1932) consider that several of these genera are synonymous. They hold that *Sepicola* Claus, *Eolidicola* M. Sars and *Doridicola* Leydig are synonymous with *Lichomolgus* Thorell and that though this last genus appears to have priority, " Le deplacement de *Lichomolgus* au profit de *Doridicola*, legitime en theorie, serait un admirable exemple d'application mecanique, aveugle, irraisonée et malfaisante de la loi de priorité." They also regard *Linckiomolgus* Stebbing and *Paralichomolgus* Thompson and A. Scott as synonyms of *Stellicola* Kossmann and place this last as a subgenus of *Lichomolgus* Thorell, while *Macrochiron* Brady is regarded as another subgenus of the same genus.

In their definition of the subgenus *Stellicola* Kossmann, Monod and Dollfus (1932, p. 142) state that the 1st antenna possesses 8 segments and then qualify this by adding " (toujours ?) " ; Kossmann (1877) records five species which he refers to this genus, namely :

Stellicola thorelli.
S. oreastriphilus.
S. semperi.
S. alabatensis.
S. pleurobranchi.

He does not designate any particular species as the type of the genus, so by the rules of nomenclature the first to be described, namely *Stellicola thorelli*, must be taken as the type. In four of the five species Kossmann states that the 1st antenna is composed of 7 segments. Monod and Dollfus have transferred *Stellicola alabatensis* Kossmann to the genus *Macrochiron* and they regard *Stellicola semperi* Kossmann as identical with *Linckiomolgus cœruleus* Stebbing and possibly also with *Paralichomolgus longicaudatus* Thompson and A. Scott. I am very doubtful as to the correctness of this view ; as already mentioned *Stellicola semperi* Kossmann is stated to have 7 segments in the 1st antenna, whereas both *Linckiomolgus cœruleus* Stebbing and the two species of *Paralichomolgus*, *P. longicaudatus* Thompson and A. Scott and *P. curticaudatus* Thompson and A. Scott, possess eight segments ; and the similarity between the two genera *Linckiomolgus* and *Paralichomolgus* seems to be more apparent than real, for in the former the 1st and 2nd segments of the antennule are of moderate length and the 3rd is long, whereas in *Paralichomoglus* the 2nd segment is very long and the 3rd extremely short, so that the number of original free segments that have become fused together to form these segments must be quite different in the two. Another character, which Monod and Dollfus (1932) give for the subgenus *Stellicola*, is " céphalothorax toujours trés dilaté et à bords latéraux des somités thoraciques 2–4 aigus, bi-dentés, denticulés, trés rarement arrondis " ; here, too, the bidentate character of the 4th thoracic segment is not constant, for it is absent in *Stellicola orbicularis* (Monod) [= *Paralichomolgus orbicularis* Monod (1928)], and is indicated by a clearly marked emargination in a new species that I have referred to the genus *Lichomolgus*, *L. rotundatus* sp. nov.

The setal formula in the various genera of the subfamily Lichomolginæ shows but little difference in the structure of the anterior two pairs of legs, but there appears to have been a progressive reduction in the number of setæ and spines in the two posterior pairs, and especially in the 4th swimming leg. The most primitive condition, in which the number of setæ and spines is highest, is to be found in the species that Monod described under the name *Paralichomolgus orbicularis* ; here the setal formula is

	Endopod.			Exopod.							
	1.	2.	3.	1.		2.		3.		
	Si.	Si.	Si. Se.	Si.	Se.	Si.	Se.	Si.	St.	Se.
P1	1	1	4, IV	0	I	1	I	4	I	III
P2	1	2	3, III	0	I	1	I	5	I	III
P3	1	2	2, III	0	I	1	I	5	I	III
P4	1	1, II		0	I	1	I	5	I	III

Unfortunately Kossmann does not give a full account of the number of setæ and spines on the limbs of his species *Stellicola thorelli*, nor does Stebbing for his genus *Linckiomolgus*. Thompson and A. Scott are equally uninformative regarding the legs in their genus *Paralichomolgus*. Certain differences are to be found within the limits of the genus *Lichomolgus* Thorell ; the full complement of spines and setæ for this genus occurs in the species *L. robustus* Thompson and A. Scott. Here the formula is as follows :

	Endopod.			Exopod.								
	1.	2.	3.	1.		2.		3.		
	Si.	Si.	Si. Se.	Si.	Se.	Si.	Se.	Si.	Se.	Se.
P1	1	1	5, I	0	I	1	I	4	I	III
P2	1	2	3, III	0	I	1	I	5	I	III
P3	1	2	2, III	0	I	1	I	5	I	III
P4	1	1, II		0	I	1	I	5	I	III

In *Lichomolgus gracilis* Thompson and A. Scott there has been a reduction of one spine on the external margin of the 3rd segment of the 4th leg, so that for this appendage the formula is

P4	1	1, II	0	I	1	I	5	I	II

The next stage in reduction, in which there are only two spines on the 2nd segment of the endopod of the 4th leg, the seta on the inner margin of that segment having been suppressed, is to be found in a group of species from the Indian Ocean, namely *L. dentipes* Thompson and A. Scott and *L. foxi* Gurney, and the formula for leg 4 becomes

P4	1	II	0	I	1	I	5	I	III

A further stage of reduction has resulted in the suppression of one of the marginal spines on the 3rd segment of the exopod of the 4th leg, thus giving the formula :

P4	1	II	0	I	1	I	5	I	II

This condition is present in a number of species, some of which occur in the Indo-Pacific region and others in the North Atlantic Ocean, namely :

Indo-Pacific Species	North Atlantic Species.
Lichomolgus gigas Thom. and A. Scots.	*Lichomolgus agilis* Leydig.
L. jeversi Thom. and A. Scott.	*L. canui* Sars.
L. rotundatus sp. nov.	*L. poucheti* Canu.
L. simplex Thom. and A. Scott.	*L. tenuifurcatus* Sars.
L. spondyle Yamaguti.*	

In the final stage of reduction in this genus the suppression of setæ has extended forward to the 3rd swimming leg and the 3rd segment of the exopod bears only two marginal spines, instead of the usual three, thus giving the formula for this leg of

P3	1	2	2, III	0	I	1	I	5	I	II

This formula is to be found in *Lichomolgus albens* Thorell, *L. marginatus* Thorell, both known from the North Atlantic Ocean and *Lichomolgus forficula* Thorell and *L. furcillatus*

* Yamaguti states that there are only 4 setæ on the inner margin of the 3rd segment of the exopod of the 2nd leg, whereas in all the other species of the group there are 5.

Thorell which, in addition to the North Atlantic Ocean, are also present, according to Kossmann, in the Red Sea. From Stebbing's figures it would appear that the setal formula for his genus *Linckiomolgus* is very like that of some species of *Lichomolgus* in that there are only two spines on the outer margin of the terminal segment of the exopod of the 3rd and 4th legs; but the seta on the inner margin of the 1st segment of the endopod of legs 1 and 2 is also lacking.

Brady (1910, p. 57i, fig. lviii) in his account of the species *L. tenuicornis* from the Antarctic Ocean shows only a single spine on the outer margin of the 3rd segment of the exopod of the 4th leg.

Similar differences between groups of species are to be found in the genus *Macrochiron*. Gurney (1927*b*, p. 463) has called attention to the gradual reduction in the number of segments in the endopod of the 4th swimming leg in various genera of this subfamily.

Genus.	Number of segments in the endopod of the 4th leg.
Lichomolgus Thorell	Two-jointed.
Macrochiron Brady	One- or two-jointed.
Lichomolgella Sars	One-jointed.
Pseudanthessius Claus	One-jointed.
Heteranthessius T. Scott	Endopod absent.

And to this list we can add—

Paralichomolgus Thompson and A. Scott	Two-jointed.
Linckiomolgus Stebbing	Two-jointed.
Nasomolgus gen. nov.	Two-jointed.
Kelleria Gurney	One-jointed.

It seems to me very doubtful whether species with only one joint in the endopod of this leg should be referred to the same genus as species in which there are two joints. In the genus *Macrochiron* Brady the type of the genus, *M. fucicolus* Brady, possesses two segments, and I propose that this species and those like it that have two segments in the endopod of the 4th leg, should be regarded as a subgenus *Macrochiron*, while those other species in which the endopod has only a single segment should be grouped in a separate subgenus, for which I propose the name *Paramacrochiron* nov.

In *Macrochiron* (*Macrochiron*) *robustus* Thompson and A. Scott, *M.* (*M.*) *buddhemsis* Thompson and A. Scott and *M.* (*M.*) *spinipes* sp. nov., the 3rd segment of the exopod of the 4th leg bears three marginal spines, in addition to the end spine, and the full formula for the leg is

	Endopod.		Exopod.								
	1.	2.	1.		2.		3.				
			Si.	Se.	Si.	Se.	Si.	St.	Se.		
P4	1	II	0	I	1	I	5	I	III		

In certain other species, however, such as

Macrochiron (*Macrochiron*) *hirsutus* T. Scott.
M. (*M.*) *congœnsis* T. Scott.
M. (*M.*) *simplex* Thompson and A. Scott.

this segment bears only two marginal spines, so that the formula is

P4 . 1 . II . 0 I . 1 I . 5 I II

It seems probable that variations may occur within the limits of a single species, for, whereas Brady (1880, pl. lxxxv, fig. 9) figures this appendage in *Macrochiron fucicolus* Brady as possessing the formula

P4 . 0 . II . 0 I . 1 I . 5 I II

and T. Scott (1912, pl. xii, fig. 25) shows exactly the same arrangement in specimens taken in weed in the North Atlantic Ocean. Sars (1913–18, pl. xci) figures examples from Norway as having the formula

P4 . 0 . II . 0 I . 1 I . 5 I III

In the case of the species *Macrochiron hirsutipes* T. Scott it seems possible that this difference may be exhibited by the two sexes, for in the female from the present collection the condition present was

P4 . 1 . 1, II . 0 I . 1 I . 5 I III

T. Scott, however, in his original account of the species shows only two marginal spines on the 3rd segment of the exopod and Sars (1913–18, pl. xcii) agrees with this; in what I believe to be the corresponding male the formula for the leg was

P4 . 1 . 1, II . 0 I . 1 I . 5 I II

thus agreeing with Scott and Sars.

Differences may occur in other legs for T. Scott in his original account (1893, pl. iv, fig. 8) shows the 1st leg as having the formula

P1 . 1 . 1 . 4, II . 0 I . 1 I . 4 I III

the last segment of the endopod bearing four setæ and two spines, but Sars (1913–18, pl. xcii) shows 5 setæ and a single spine on the last segment of the endopod, so that the formula is

P1 . 1 . 1 . 5, I . 0 I . 1 I . 4 I III

In the subgenus *Paramacrochiron* and the genera *Lichomolgella* Sars, *Pseudanthessius* Claus and *Kelleria* Gurney the number of marginal spines on the terminal segment of the

4th leg appears to be constant; so far as the known species are concerned the endopod of the 4th leg is composed of only a single segment and they all possess the formula

P4 . II . 0 I . 1 I . 5 I II

Key to the Genera of the Subfamily Lichomolginæ.

1. 1st antenna composed of 8 segments 2
   1st antenna composed of 7 segments 3
2. 1st and 2nd segments of 1st antenna of moderate length and the 3rd long . . *Linckiomolgus.*
   2nd segment of the 1st antenna very long and the 3rd segment extremely short . *Paralichomolgus.*
3. 2nd maxilla armed with stout teeth; maxilliped stout in female, 2nd and 3rd joints armed with large spines . . . . . *Kelleria.*
   2nd maxilla armed with spinules . . . . . 4.
4. Maxilliped in female small, terminal segment conical . . . . . 5.
   Terminal segment of maxilliped rod-like and bearing a long spine . . . . *Nasomolgus.*
5. P5 reduced to a single spine and 2 setæ, and fused with the thoracic segment . . *Pseudanthessius.*
   P5 with a free segment . . . . . 6.
6. Endopod of P4 absent . . . . . *Heteranthessius.*
   Endopod of P5 present . . . . . 7.
7. Endopod of P4 composed of 3 segments . . . . . *Paranthessius.*
   Endopod of P4 composed of 2 segments . . . . . 8.
   Endopod of P4 composed of a single segment . . . . . 9.
8. Maxilla 2 with lappet much produced; P5 with free joint comparatively small . *Lichomolgus.*
   Maxilla 2 with lappet conspicuously dilated at base; P5 with free joint long and slender *Macrochiron.*
9. 1st maxillary palp tri- or quadri-setose; apical lash of maxilla 2 long and slender and armed with numerous teeth . . . . . *Paramacrochiron.*
   1st maxillary palp bi-setose; apical lash of maxilla 2 short and stout and armed with few spines *Lichomolgella.*

Genus *Lichomolgus* Thorell.

Lichomolgus, Canu, 1892, p. 227; Sars, 1913–18, p. 150.

Several species belonging to this genus have been recorded from the Indian Ocean. Thompson and A. Scott (1903) recorded a number of species from the Ceylon Pearl Banks and referred them to this genus, but since then several have been transferred to other genera; those that appear to belong to the genus *Lichomolgus* are

Lichomolgus gracilis Thom. and A. Scott.
L. jeversi Thom. and A. Scott.
L. lankensis Thom. and A. Scott.
L. elegans Thom. and A. Scott.
L. gigas Thom. and A. Scott.
L. dentipes Thom. and A. Scott.
L. robustus Thom. and A. Scott.

A. Scott (1902) had previously recorded one species, *Lichomolgus minor*, from the Red Sea, and subsequently (1909) recorded *L. elegans* Thom. and A. Scott and *L. gigas* Thom. and A. Scott, as well as two new species, *Lichomolgus anomalus* and *L. gracilipes*, from the Malay Archipelago, but of these the last named appears to belong to the genus *Macrochiron* and Monod and Dollfus (1932, p. 139) have suggested that perhaps *Lichomolgus anomalus* A. Scott should also be removed to that genus. Gurney (1927) recorded *L. minor* A. Scott

and three new species, *L. vagans*, *L. ægyptius* and *L. foxi*, from the Suez Canal. The genus would thus appear to be well represented in Indian waters, but in the present collection I have discovered only two species, one of which appears to be new.

Lichomolgus anomalus A. Scott.

Lichomolgus anomalus, A. Scott, 1909, p. 264, Pl. lxvii, figs. 6–17.

Occurrence.—Station 45, South coast of Arabia, depth 38 m. One female. In debris from a jar of Alcyonacea.

Remarks.—In its general appearance the present specimen appears to be somewhat less broad across the cephalothorax than the specimen figured by A. Scott; but in all other respects it agrees closely with Scott's description.

Distribution.—This species has now been recorded from the Malay Archipelago (A. Scott) from invertebrata dredged at a depth of 1595 metres, and the south coast of Arabia (present record) in 38 metres depth.

Lichomolgus rotundus sp. nov. (Text-fig. 23, A–H).

Occurrence.—Addu Atoll, Maldive Archipelago; in weed-washings. One female.

Descriptive Notes.—♀. Total length 0·7 mm.

The proportional lengths of the anterior and posterior regions of the body (Text-fig. 23, A) are as 2 to 1. The anterior region is very broad and is almost circular in outline, the broadest part being at the posterior margin of the cephalic segment. The cephalon and 1st thoracic segment are clearly demarcated off from one another. The postero-lateral angles of the 1st and 2nd thoracic segments are produced into small pointed processes; the 3rd segment has an emarginate outer border and the 4th segment is very small with rounded outer margins. The segments of the posterior region of the body have the following proportional lengths:

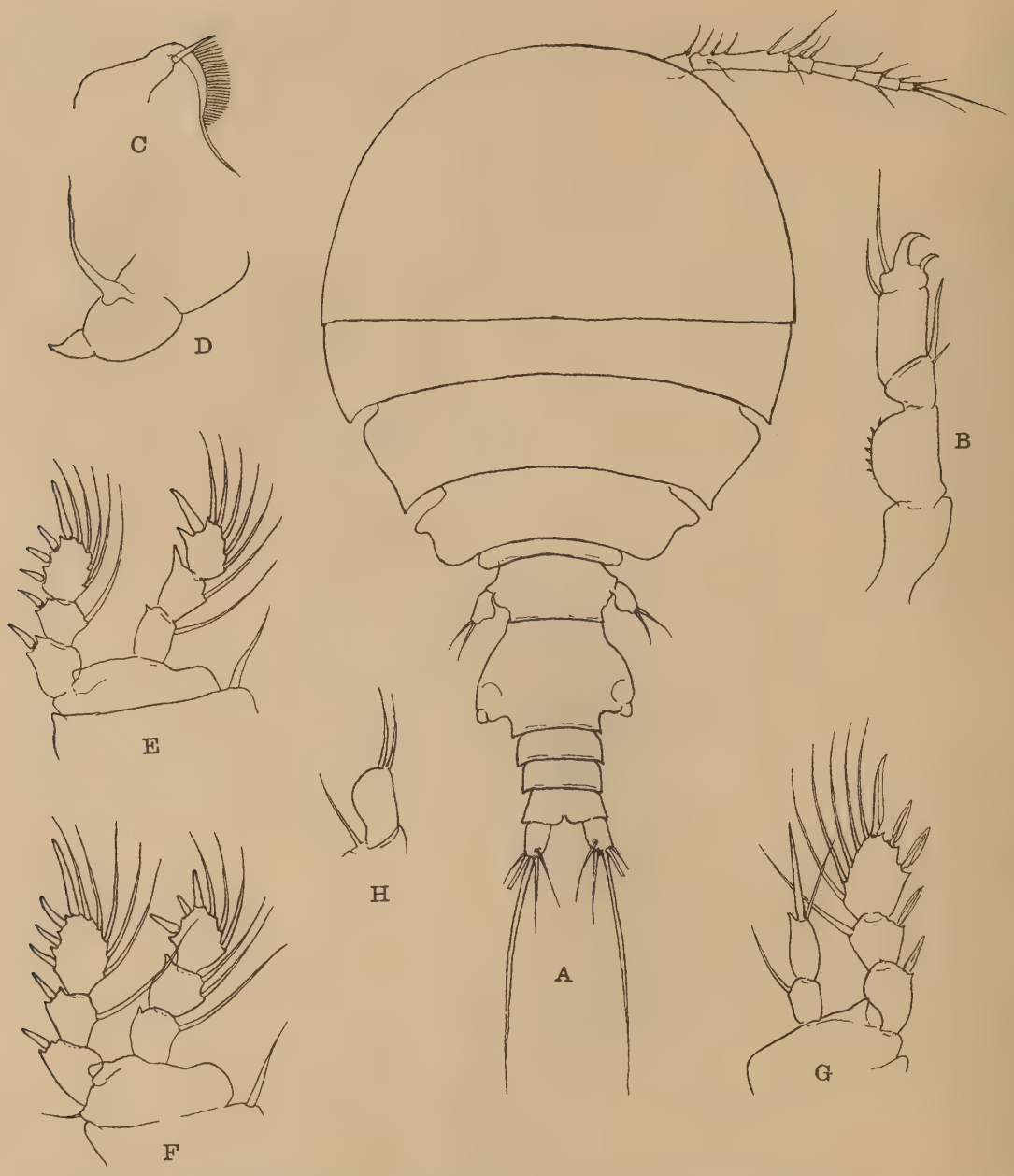
Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
20	41	10	8	10	11 = 100

In the genital segment the anterior region is very broad, and on each side is produced in a rounded mammilliform prominence, that is directed postero-laterally; the small posterior region of the segment is abruptly narrowed. The three posterior segments are of approximately equal length and are about two and a half times as broad as long. The furcal rami are very slightly longer than the anal segment and are also slightly longer than broad; the 2nd furcal seta is about equal in length to the whole abdomen.

The 1st antenna reaches back nearly to the posterior border of the cephalon; it consists of the usual 7 segments that have the following proportional lengths:

Segment 1.	2.	3.	4.	5.	6.	7.
16	35	16	16	12	9	6 = 100

The 2nd antenna (Text-fig. 23, B) is composed of four segments, of which the 2nd is slightly swollen and is armed along its posterior margin with a row of small spinules, the 3rd is short and bears two unequal setæ and the terminal joint bears two unequal, curved, claws distally.



TEXT-FIG. 23.—*Lichomolgus rotundatus* sp. nov., ♀. A, Dorsal aspect. B, 2nd antenna. C, 2nd maxilla. D, Maxilliped. E, 1st swimming leg. F, 2nd swimming leg. G, 4th swimming leg. H, 5th leg.

The mouth-parts appear to have the same general characters as the other members of the genus.

The maxilliped (Text-fig. 23, D) is short and stout. The 2nd segment bears a long seta, the base of which is thickened.

In the 1st swimming leg (Text-fig. 23, E) the 2nd segment of the endopod is produced at its outer distal angle in a well-developed spinous projection; the 3rd segment bears

five setæ, and a stout spine at its distal outer angle, the spine being as long as the segment itself.

In the 4th leg (Text-fig. 23, G) the exopod bears only two marginal spines on the 3rd segment ; the endopod is composed of two segments, of which the proximal bears a single inner seta and the distal carries a seta and a spine, of approximately equal length, at the distal end.

The 5th leg (Text-fig. 23, H) is short and the free segment is swollen and somewhat produced on its outer margin ; it carries two setæ distally.

Remarks.—At first sight this species is very likely to be confused with *Paralichomolgus curticaudatus* Thompson and A. Scott.

Genus *Macrochiron* Brady.

Macrochiron, Brady, 1872, p. 433.
Macrocheiron, Sars, 1913–18, p. 163.

The separation of the species of this genus from those of *Lichomolgus* and *Pseudanthessius* is a matter of some difficulty. Gurney (1927*b*, p. 463) has suggested that the species *Pseudanthessius maximus* Thompson and A. Scott, *P. chelifer* Thompson and A. Scott and *P. parvus* A. Scott "should, at least provisionally, be referred to *Macrocheiron*, though that genus cannot be very strictly defined." Monod and Dollfus (1932, p. 139) have attributed the following species to this genus :

Pseudanthessius maximus Thompson and A. Scott.
P. chelifer Thompson and A. Scott.
P. parvus A. Scott.
Lichomolgus alabatensis Kossmann.
L. trochi Canu.
L. buddhensis Thompson and A. Scott.
L. elegans Thompson and A. Scott.
L. gracilipes A. Scott.

I have already pointed out that I am of the opinion that it is inadvisable to include species that possess only one segment in the endopod of the 4th leg in the same group with those that have two segments in this ramus. Since the type species of the genus, *Macrochiron fucicolum* Brady, possesses two segments in this ramus I propose to separate species with this type of leg in a subgenus *Macrochiron* and to erect a new subgenus *Paramacrochiron*, for those species in which the endopod of the 4th leg is composed of a single segment only.

Subgenus *Macrochiron*.

In this subgenus I include the following species :

Macrochiron fucicolum Brady, the type of the subgenus,
M. hirsutipes (T. Scott),

and to these, in my opinion, should be added

Lichomolgus alabatensis (Kossmann),
L. simplex Thompson and A. Scott,
L. buddhensis Thompson and A. Scott,
L. robustus Thompson and A. Scott,

and perhaps also *Lichomolgus gracilipes* A. Scott and *Lichomolgus congoensis* T. Scott. T. Scott (1894, p. 120) has himself remarked on the similarity of the various appendages of *Lichomolgus congoensis* to those of *Macrochiron fucicolum* Brady.

In the present collections are three species, two of which appear to be new, that must be attributed to this subgenus.

? *Macrochiron* (*Macrochiron*) *hirsutipes* (T. Scott). (Text-fig. 24, A–G, and Text-fig. 25, A–H.)

Lichomolgus hirsutipes, T. Scott, 1893, p. 206, pl. iv, figs. 1–12.
Macrocheiron hirsutipes, Sars, 1913–18, p. 165, pl. xcii.

Occurrence.—Addu Atoll, Maldive Archipelago ; in weed-washings. Two females and one male.

Descriptive Notes.—♀. Total length 1·50 and 1·58 mm.

This is slightly larger than the specimens examined by either T. Scott, which measured 1·4 mm., or by Sars, which were 1·3 mm. The proportional lengths of the anterior and posterior regions of the body (Text-fig. 24, A) are as 8 to 5. The anterior region is robust. The cephalon is broadly rounded anteriorly and the rostrum is triangular and depressed. The line of demarcation between the cephalon and the 1st thoracic segment is only faintly indicated. The posterior thoracic segments exhibit rounded margins and their respective widths rapidly decrease, so that the body narrows. The widest part of the anterior region lies at the posterior end of the cephalon. The proportional lengths of the segments of the posterior region are as follows :

Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
14	42	12	8	10	14 = 100

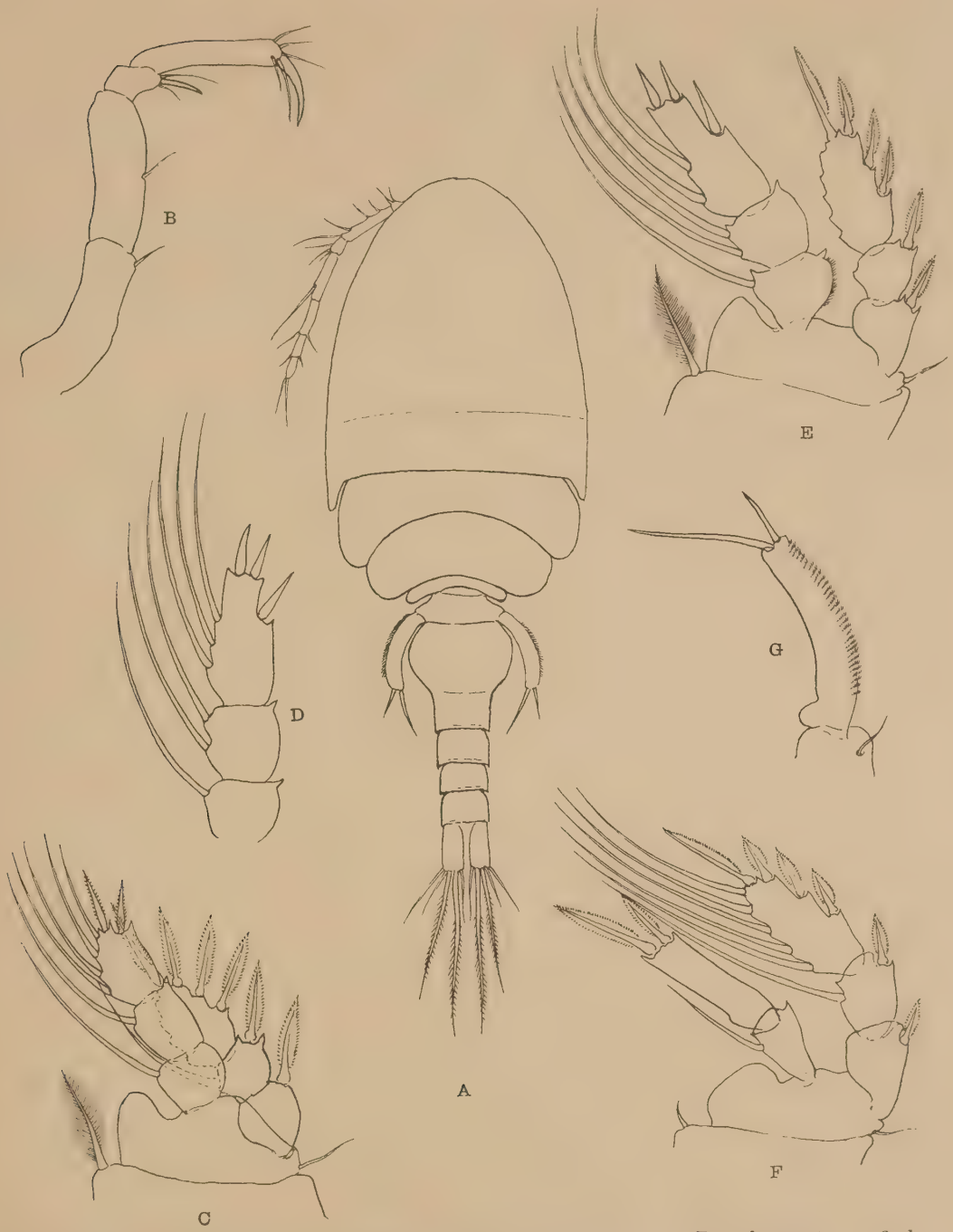
The anterior two-thirds of the genital segment forms a sub-globular swelling, while the posterior third is cylindrical. The anal segment is slightly longer than the preceding one and the furcal rami are nearly one and a half times as long as the anal segment and are about one and a half times as long as wide.

The 1st antenna is composed of the usual seven segments that have the following proportional lengths ; and for convenience of reference I have converted the lengths for the segments as given by T. Scott into parts per hundred of the whole length of the appendage :

Segment	1.	2.	3.	4.	5.	6.	7.
	15	27	6	20	15	11	6 = 100 present specimens.
L. hirsutipes	14	32	6	14	15	11	8 from T. Scott.

While the figures on the whole agree fairly well, in Scott's specimens the 4th segment was very slightly shorter than the 5th, whereas in the present examples it was distinctly longer. The appendage reaches back to a little more than half way along the combined cephalon and 1st thoracic segment.

The 2nd antenna (Text-fig. 24, B) is of the prehensile type. The 3rd segment is very short and the 4th is about equal to the 2nd, as figured by Sars ; T. Scott in his figure of



TEXT-FIG. 24.—*Macrochiron* (*Macrochiron*) *hirsutipes* (T. Scott), ♀. A, Dorsal aspect. B, 2nd antenna. C, 1st swimming leg. D, Endopod of 2nd swimming leg. E, 3rd swimming leg. F, 4th swimming leg. G, 5th leg.

the appendage shows this segment as being somewhat shorter. I was only able to detect a single curved claw-like spine arising from the distal end of the 4th segment in this sex, though in one of the appendages in the male there were two, thus agreeing with T. Scott and Sars.

I was unable to make a complete study of the mouth-parts. In the present specimen the basal part of the biting edge of the 2nd maxilla was provided with a series of about 6 spines, which suddenly give place in the distal part to closely-set, fine, needle-like spinules; the extreme distal end of the lash was broken off. T. Scott states that in his examples this edge was strongly pectinate in the upper part, but plumose towards the end.

In the 1st swimming leg (Text-fig. 24, C) the exopod and endopod are of about equal length. The 3rd segment of the endopod is in the present specimen armed with four setæ on the inner margin and two sub-equal spines at the distal end; this agrees exactly with the figure given by T. Scott (1893, pl. iv, fig. 8) in his original account of the species, but Sars shows his specimens as possessing 5 setæ and only a single spine on this joint (Sars, 1913–18, pl. xcii).

The 2nd (Text-fig. 24, D) and 3rd (Text-fig. 24, E) legs closely resemble those of *Macrochiron hirsutipes*, as figured by Sars. In the 4th leg (Text-fig. 24, F) the endopod is well developed and is about three-fourths as long as the exopod; it is composed of two segments, of which the proximal bears a single inner seta and the distal is armed with two unequal spines, the outer being only about half the length of the inner. Both Scott and Sars show the terminal segment of the exopod as having only two marginal spines, whereas in the present specimen there are three, in addition to the end-spine.

The 5th leg (Text-fig. 24, G) is well developed and reaches back to the level of the posterior end of the swollen portion of the genital segment, as figured by T. Scott (1893, pl. iv, fig. 1); Sars (1913–18, pl. xcii) shows it as reaching only to about half this distance. The free segment is curved and is dilated in a rounded swelling on the inner side at the proximal end. The outer aspect of this segment is densely hairy, the hairs being arranged in parallel rows.

♂. In the male the genital segment (Text-fig. 25, A) is markedly swollen and is subglobular. In length it is about equal to the rest of the abdomen. In each postero-lateral region there is a small projection, that bears two small setæ. The furcal rami are about equal in length to the anal segment.

The 1st antenna (Text-fig. 25, B) resembles that of the female. The 2nd antenna (Text-fig. 25, C) resembles that of the female, but the number of claw-like spines on the distal segment differed on the two sides; on one side there is, so far as I could see, only one spine, as in the female, whereas on the other there were two.

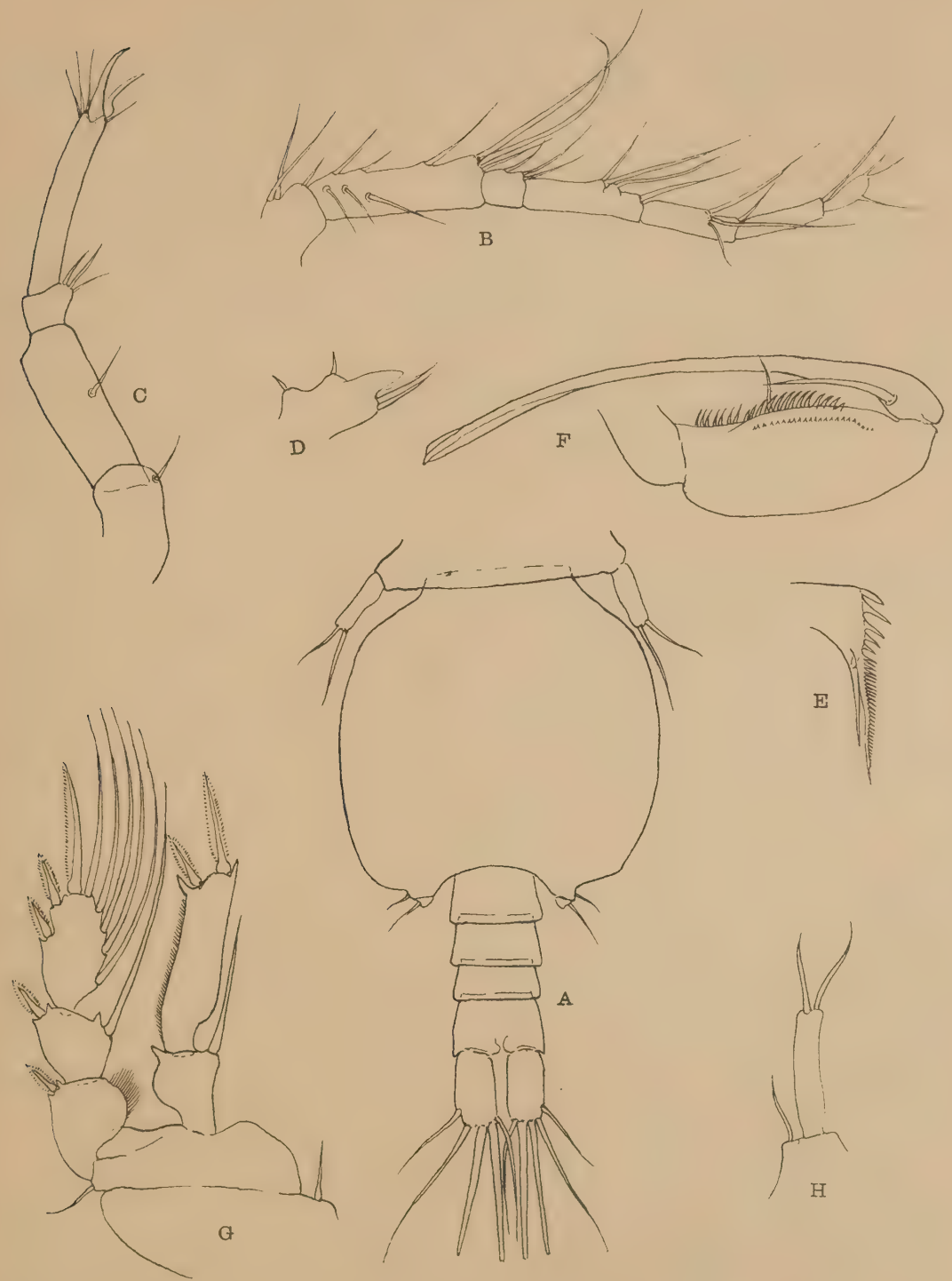
The 1st maxilla (Text-fig. 25, D) bears two small setæ on the inner margin and two, somewhat larger arise close together on the outer side at the base of a conical projection.

The maxilliped (Text-fig. 25, F) forms a powerful grasping organ. The hand is armed with three rows of spinules; one row runs along the proximal portion of the inner margin and a second, composed of needle-like spines, runs along the distal three-fourths of the inner aspect, while in the distal half of the segment a third row of smaller spinules runs parallel to the latter. The terminal claw is at least twice the length of the hand.

In the 4th leg (Text-fig. 25, G) the 3rd segment of the exopod in this sex bears only two marginal spines. The 2nd segment of the endopod is emarginate near the proximal end on the inner border and the ramus reaches as far as the distal end of the exopod.

The 5th leg (Text-fig. 25, H) is considerably smaller than in the female.

Remarks.—The accounts of this species given by T. Scott and by Sars reveal certain small differences, and the present specimens agree sometimes with one account and some-



TEXT-FIG. 25.—*Macrochiron* (*Macrochiron*) *hirsutipes* (T. Scott), ♂. A, 5th thoracic segment and abdomen. B, 1st antenna. C, 2nd antenna. D, 1st maxilla. E, 2nd maxilla. F, Maxilliped. G, 4th swimming leg. H, 5th leg.

times with the other. I am inclined to believe that these differences are due to variations, possibly local, in a single species.

Distribution.—If I am right in attributing the above examples to *M. hirsutipes* (T. Scott), then this species has a wide distribution ranging from the Indian Ocean to the North Atlantic Ocean and the Arctic Ocean.

Macrochiron (*Macrochiron*) *longipes* sp. nov. (Text-fig. 26, A–I.)

Occurrence.—Addu Atoll, Maldive Archipelago ; in weed-washings. One female.

Descriptive Notes.—♀. Total length 1·63 mm.

The proportional lengths of the anterior and posterior regions of the body (Text-fig. 26, A) are as 31 to 19. The cephalon is almost completely fused with the 1st thoracic segment, only a slight indentation in the lateral margin marking the line of demarcation. The widest part of the anterior region lies opposite the 1st thoracic segment. The 4th thoracic segment is very small. The abdomen is comparatively slender and the segments of the posterior region of the body have the following proportional lengths :

Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
9	35	14	10	16	16 = 100

The genital segment is swollen in the anterior third of its length, but behind this is abruptly constricted and remains cylindrical for the rest of its length ; the genital apertures can be seen in the dorso-lateral region just behind the dilated region. The 3rd free segment (segment 4) is considerably shorter than the segments in front or behind it. The furcal rami are as long as the anal segment and are about twice as long as broad.

The 1st antenna (Text-fig. 26, B) is composed of the typical seven segments that have the following proportional lengths :

Segment 1.	2.	3.	4.	5.	6.	7.
15	27	5	21	16	11	5 = 100

It reaches back nearly to the posterior margin of the cephalic segment.

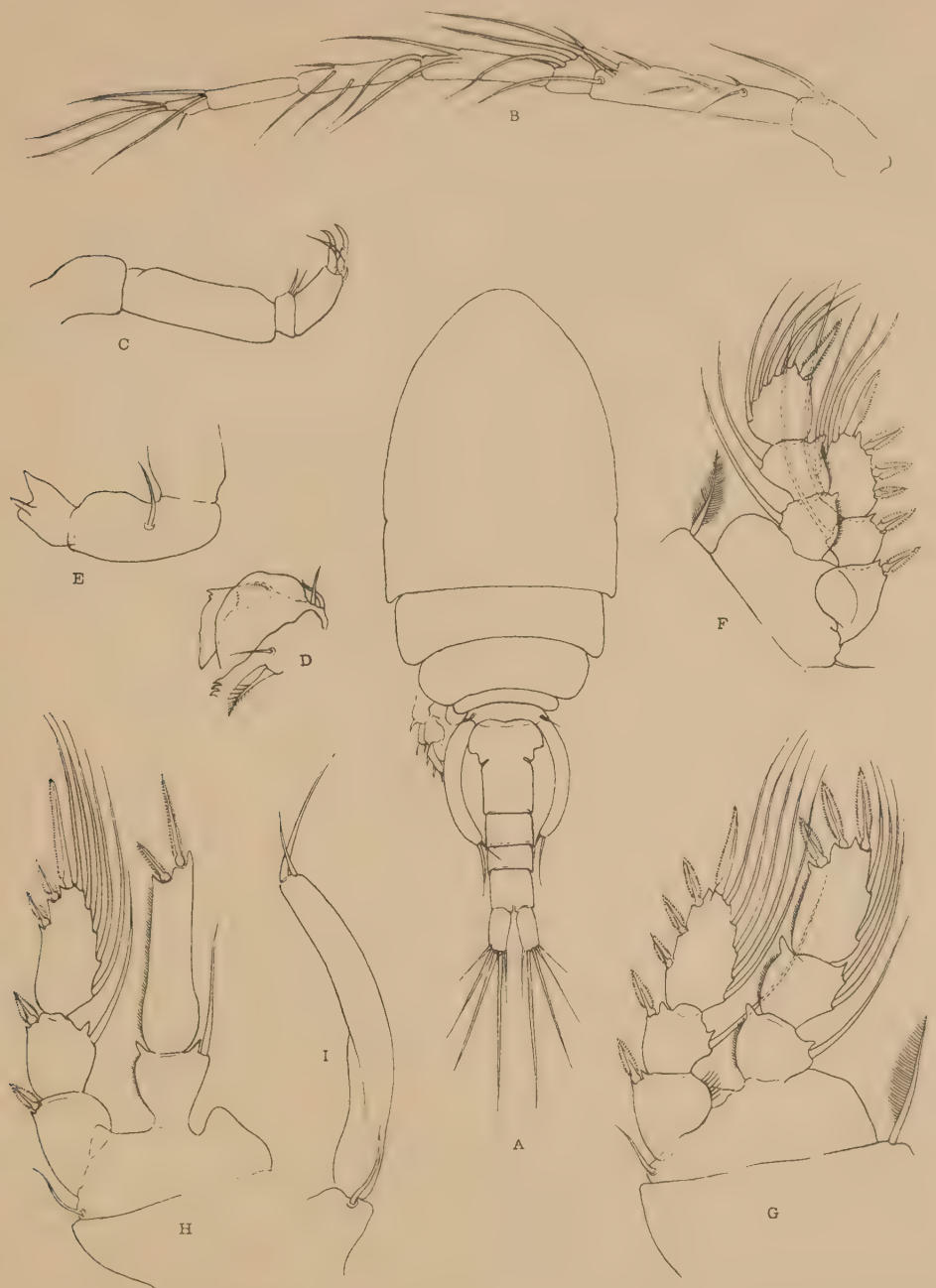
The 2nd antenna (Text-fig. 26, C) is prehensile. The terminal segment is relatively short, being about half the length of the 2nd segment ; it bears two claw-like, geniculate spines and one seta at the distal end, and a small, curved spine at the distal outer angle.

The mouth-parts (Text-fig. 26, D) appear to have the usual characters of the genus, but they were unfortunately damaged during dissection.

The 2nd maxilla is toothed along the proximal part of the biting edge ; a plumose seta arises from the posterior margin and a second seta arises from the surface near the base.

The maxilliped (Text-fig. 26, E) is composed of three segments ; the 2nd bears a moderately long seta, and the terminal segment is produced in a conical prominence at the base of which arises a stout spine, the two together forming a small claw.

In the swimming legs the anterior three pairs have three-jointed rami. The 3rd segment of the endopod of the 1st leg (Text-fig. 26, F) bears five setæ on the inner margin and a single spine at the distal outer angle. In the 4th leg (Text-fig. 26, H) the 3rd segment of the exopod bears only two marginal spines, that arise from the distal half of the segment :



TEXT-FIG. 26.—*Macrochiron* (*Macrochiron*) *longipes* sp. nov., ♀. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, 1st and 2nd maxillæ. E, Maxilliped. F, 1st swimming leg. G, 3rd swimming leg. H, 4th swimming leg. I, 5th leg.

the endopod is composed of two segments, of which the proximal bears a single inner seta and the distal is armed with two unequal spines.

The 5th leg (Text-fig. 26, I) is composed of a basal part that bears a single seta and a very long slender free segment, which reaches back as far as the posterior border of the 2nd free abdominal segment (segment 3) and distally bears two unequal setæ.

Macrochiron (*Macrochiron*) *spinipes* sp. nov. (Text-fig. 27, A–I.)

Occurrence.—Nankauri Harbour, Nicobar Islands; in weed-washings. A single female.

Descriptive Notes.—♀. Total length 1·23 mm.

The proportional lengths of the anterior and posterior regions of the body (Text-fig. 27, A) are as 63 to 37. The cephalon is fused with the 1st thoracic segment; anteriorly it is narrowly rounded. The free thoracic segments diminish gradually in size from before backwards; their lateral margins are expanded and rounded. The posterior region of the body, with the exception of the anterior region of the genital segment, is comparatively slender. The proportional lengths of the various segments of this region are as follows:

Th. 5.	Abd. 1-2.	3.	4.	5.	Furca.
11	41	11	16	14	7 = 100

The anterior two-thirds of the genital segment is dilated and is sub-triangular in shape; behind this the segment narrows abruptly. The furcal rami are very short and broad, being only half the length of the anal segment and broader than long in the proportion of 12 to 10. The 2nd furcal seta is as long as the whole abdomen.

The 1st antenna (Text-fig. 27, B) is comparatively long, reaching back more than three-fourths the length of the combined cephalon and 1st thoracic segment; it consists of the usual seven segments, that have the following proportional lengths:

Segment 1.	2.	3.	4.	5.	6.	7.
17	29	7	17	14	10	6 = 100

The 2nd antenna (Text-fig. 27, C) is prehensile and is composed of the usual four segments; the terminal segment bears at the distal end one long claw-like spine and a single seta. In this respect the appendage closely resembles that of *Lichomolgus simplex* Thompson and A. Scott, that in all probability should be referred to the genus *Macrochiron*, though the claw-like spine is somewhat more delicate (*cf.* Thompson and A. Scott, 1909, pl. xv, fig. 29). The 1st, 2nd and 4th segments are of approximately equal length, and the 3rd is extremely short.

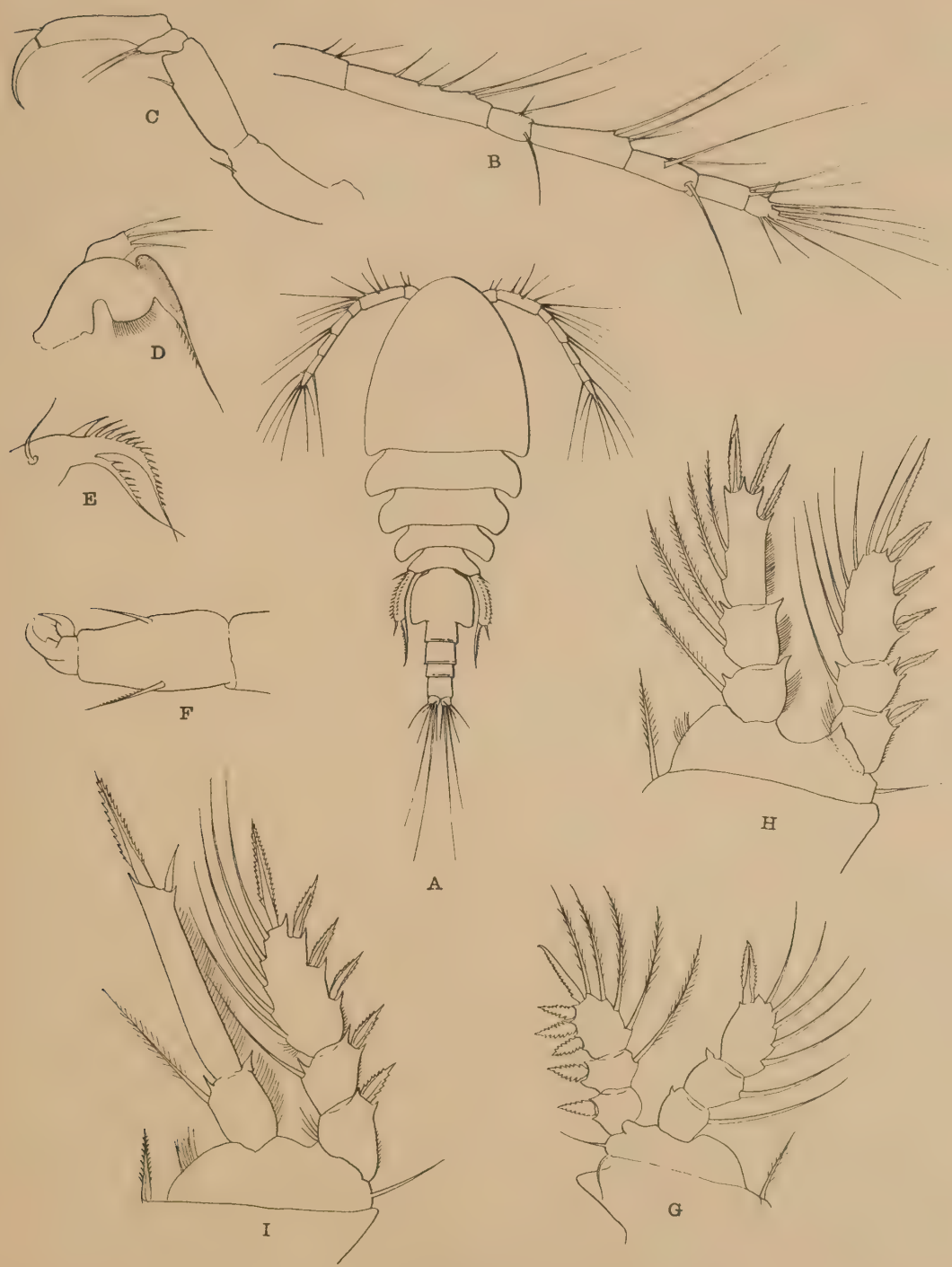
The mandible (Text-fig. 27, D) closely resembles that of *Macrochiron hirsutipes* (T. Scott), as figured by Sars (1913–18, pl. xcii); the basal dilated portion is fringed with fine hairs and the apical lash is produced in its proximal half in a falciform crest.

The 1st maxilla bears three setæ at its distal end.

The 2nd maxilla (Text-fig. 27, E) is armed with a series of teeth along the apical lash, the size of these teeth gradually diminishing; the seta that arises from the posterior margin is also armed with teeth.

The maxilliped (Text-fig. 27, F) is short and stout. It is composed of three segments, of which the 2nd bears two setæ and the distal segment is short and rounded and is produced in a claw-like process that forms with the claw-like spine that arises from it a small grasping organ.

The anterior three pairs of swimming legs (Text-fig. 27, G and H) are of the usual type. The 3rd segment of the endopod of the 1st leg is armed with five setæ on its inner margin and a single spine at the distal external angle. The 4th leg (Text-fig. 27, I) is



TEXT-FIG. 27.—*Macrochiron* (*Macrochiron*) *spinipes* sp. nov., ♀. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, 1st maxilla. E, 2nd maxilla. F, Maxilliped. G, 1st swimming leg. H, 3rd swimming leg. I, 5th leg.

characterized by the great length of the endopod, which exceeds that of the exopod: the endopod is composed of two segments, of which the proximal bears a single inner seta and the distal segment, which is three times as long as the proximal, bears a large serrated spine and a much smaller, seta-like spine. The terminal segment of the exopod bears, in addition to the end-spine, three marginal spines, thus resembling *Macrochiron fucicolum* Brady and *M. buddhensis* (Thompson and A. Scott), and differing from *M. hirsutipes* (T. Scott) according to T. Scott and Sars, and *M. longipes* sp. nov.

Each of the 5th pair of legs consists of a basal joint and a free segment: the latter is moderately long and is curved, reaching back to the level of the posterior margin of the dilated portion of the genital segment. It is armed along its outer margin with a double row of small spinules, and terminates in two unequal spines, the inner of which is serrated and is nearly as long as the segment itself.

Subgenus *Paramacrochiron* nov.

To this subgenus I have referred those species in which the endopod of the 4th leg is composed of only a single segment. These species were previously included in the genus *Pseudanthessius* Claus, but the presence of a well-developed 5th leg necessitates their removal from that genus. Such species are as follows:

Pseudanthessius maximus Thompson and A. Scott.
P. chelifer Thompson and A. Scott.
P. parvus A. Scott.
P. fucicolus T. Scott.

Two of the above species, namely *Macrochiron* (*Paramacrochiron*) *maximum* (Thompson and A. Scott), *Macrochiron* (*Paramacrochiron*) *parvum* (A. Scott) occur in the present collections, and in addition there is a third species, that appears to be new, and which I have named *Macrochiron* (*Paramacrochiron*) *malayense* sp. nov.

Macrochiron (*Paramacrochiron*) *maximum* (Thompson and A. Scott).

Pseudanthessius maximus, Thompson and A. Scott, 1903, p. 276, pl. xiv, figs. 1–11.

Occurrence.—Off Cheriya Kadamakindi, Andaman Islands; in surface tow-net. One female.

Descriptive Notes.—♀. Total length, 2·3 mm. This is considerably smaller than Thompson and A. Scott's specimens, which measured 3·5 mm.

The proportional lengths of the anterior and posterior regions of the body are as 57 to 43. The head and 1st thoracic segment are separated by a well marked suture. Thompson and A. Scott in their account of the species state that the joints of the cephalothoracic region give it a "pinnatifid" appearance. In the present specimen the lateral regions of the 2nd and 3rd thoracic segments are not expanded, and it is probable that the "pinnatifid" appearance was due to pressure from above when examining the specimen under the microscope. The 4th segment is expanded laterally. The proportional lengths of the segments of the posterior region of the body are as follows:

Th. 5.	Abd. 1-2.	3.	4.	5.	Furca.
13	30	13	8	14	22 = 100

The genital segment is somewhat expanded in the anterior region, and the genital apertures are situated on the dorso-lateral area of this expanded portion and are guarded by a small seta. The furcal rami are about one-and-a-half times the length of the anal segment.

The various appendages agree with the description given by Thompson and A. Scott.

Distribution.—Galle Harbour, Ceylon (Thompson and A. Scott) and Cheriya Kadamakindi, Andaman Islands (present record).

Macrochiron (*Paramacrochiron*) *parvum* (A. Scott).

Pseudanthessius parvus, A. Scott, 1909, p. 269, pl. lxix, figs. 1–7.

Occurrence.—Nankauri Harbour, Nicobar Islands; in weed-washings. One female.

Descriptive Notes.—♀. Total length 0·86 mm. This agrees very closely with Scott's measurement of 0·9 mm. The proportional lengths of the anterior and posterior regions of the body are as 68 to 32, so that in this specimen the length of the abdomen would appear to be somewhat shorter than in Scott's example, for he states that "the combined length of the abdomen and furcal joints is contained nearly twice in the total length of the cephalothorax from the frontal margin to the distal end of the 5th thoracic segment": possibly the difference is due to contraction of the abdomen at the moment of death. The proportional lengths of the segment of the abdomen are as follows:

Abd. 1–2.	3.	4.	5.	Furca.
49	11	9	15	16 = 100

The furcal rami are a little longer than the anal segment and are twice as long as broad.

The segments of the 1st antenna have the following proportional lengths:

Segment 1.	2.	3.	4.	5.	6.	7.
14	20	8	15	15	14	14 = 100

The mouth-parts and swimming legs agree with Scott's description.

Remarks.—The presence of well-developed 5th legs necessitates the removal of this species from the genus *Pseudanthessius* and the existence of only a single segment in the endopod of the 4th leg also excludes it from the subgenus *Macrochiron*, as I interpret it. It must be included in the subgenus *Paramacrochiron*.

Distribution.—The Malay Archipelago (A. Scott) and the Nicobar Islands (present record).

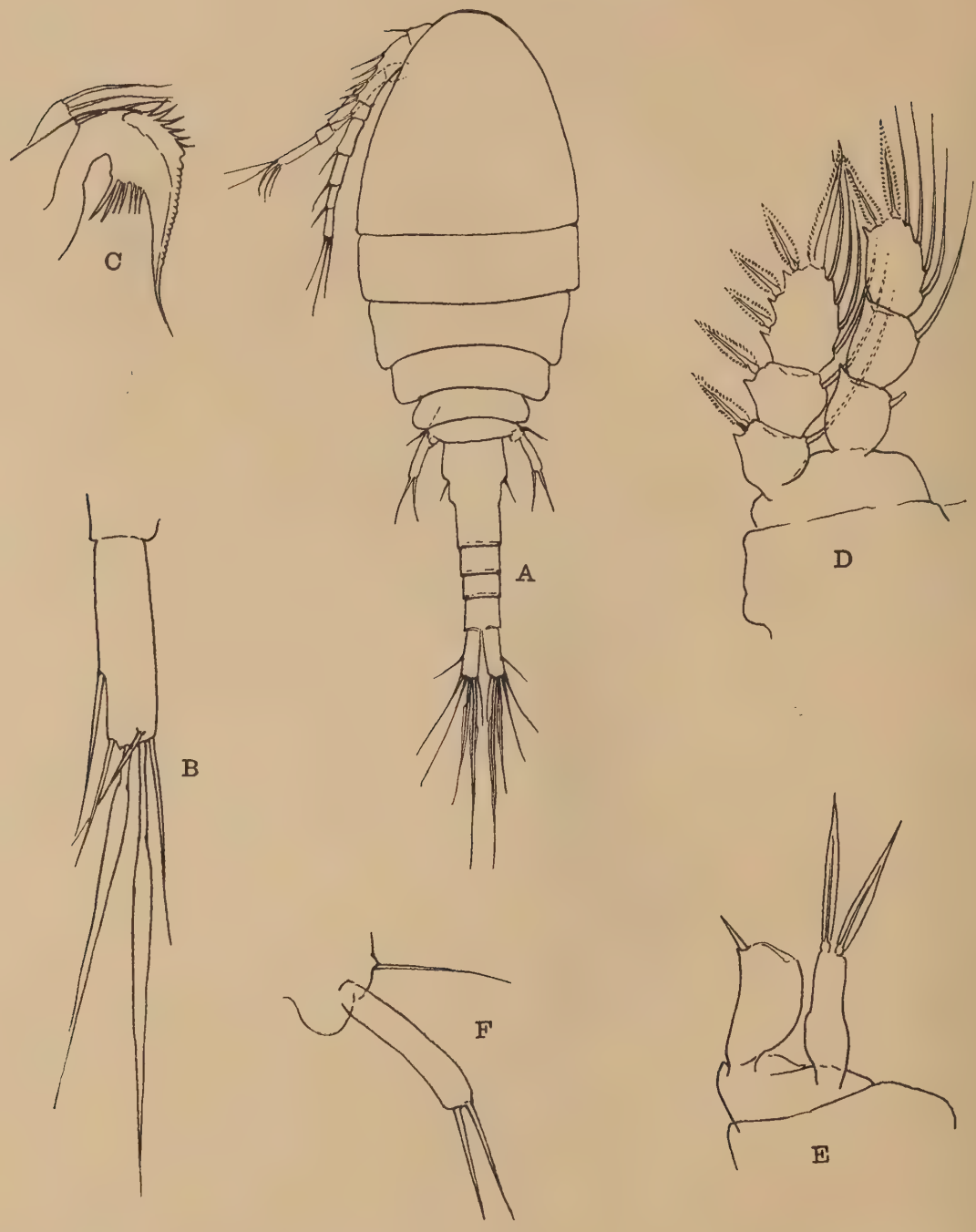
Macrochiron (*Paramacrochiron*) *malayense* sp. nov. (Text-fig. 28, A–F.)

Occurrence:

Kurau River, Perak, Federated Malay States; in surface tow-net. One female.

Off Viper Island, Port Blair, Andaman Islands; in surface tow-net. One female.

Descriptive Notes.—♀. Total length 0·66 mm.



TEXT-FIG. 28.—*Macrochiron* (*Paramacrochiron*) *malayense* sp. nov., ♀. A, Dorsal aspect. B, Furcal ramus. C, 2nd maxilla. D, 1st swimming leg. E, Basal segments and endopod of 4th swimming leg. F, 5th leg.

The animal is of slender build, the anterior region of the body forming an elongate oval. The proportional lengths of the anterior and posterior regions of the body (Text-fig. 28, A) are as 3 to 2. The forehead is rounded and the rostrum forms a thick, rounded

plate that is directed ventrally. The cephalon is clearly demarcated off from the 1st thoracic segment. The proportional lengths of the posterior region of the body are as follows :

Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
11	37	11	8	14	19 = 100

The genital segment is only moderately swollen in the anterior half of its length : the genital apertures are situated laterally at about the junction of the proximal and middle thirds of the segment, and each is armed with a delicate seta. The furcal rami are moderately elongated, being slightly less than one-and-a-half times the length of the anal segment : the 2nd and 3rd furcal setæ are modified and are, in the distal three-fourths, flattened and spear-head-shaped. The 3rd seta is about five-sixths the length of the 2nd.

The 1st antenna reaches back to just beyond the posterior margin of the cephalon : it has the usual seven segments that have the following proportional lengths :

Segment 1.	2.	3.	4.	5.	6.	7.
14	22	8	16	16	11	13 = 100

The 2nd antenna is feebly prehensile. It has the usual four segments, with the following proportional lengths :

Segment 1.	2.	3.	4.
27	39	7	27 = 100

The terminal segment is as long as the 1st and both are considerably shorter than the 2nd. The distal segment is armed with two slender claws and three setæ.

In the mandible (Text-fig. 28, C) the swollen basal part of the lash is fringed on its posterior margin with a row of elongate needle-like spines, the proximal two of which are considerably larger and stouter than the rest. On the anterior margin the basal part is armed with a row of six fine curved spines and the lash is fringed with a row of small rounded prominences. The 1st maxilla bears three terminal setæ.

In the 1st pair of legs (Text-fig. 28, D) the two rami are of approximately equal length. The 3rd segment of the endopod is armed with only four seta on the inner margin, and two spines arise from the distal border ; in this respect this species resembles *Macrochiron hirsutipes* (T. Scott) (*vide* Text-fig. 24, C).

The 2nd and 3rd legs are of the usual type.

The 4th (Text-fig. 8, E) legs were unfortunately damaged, only the proximal segment of the exopod remaining. The endopod is short and only equals the 1st segment of the exopod in length ; it is slightly swollen in its basal part and bears, at the distal end, two equal lancet-shaped spines that are equal in length to the segment itself.

The 5th legs (Text-fig. 8, F) consist of a basal segment that bears a single seta and a free segment that is slender and of moderate length, reaching back about one-third the length of the genital segment of the abdomen. Distally the free segment bears two equal setæ.

In the Kurau River this species was associated with *Kelleria gurneyi* sp. nov. and other species the presence of which indicates that the general condition was that of brackish-water (*vide infra*, p. 119).

Distribution.—The Malay Peninsula and the Andaman Islands (present records).

Genus *Kelleria* Gurney.

Kelleria, Gurney, 1927, p. 470.

This genus was established by Gurney (*loc. cit.*) to accommodate two species that were taken in the Suez Canal, namely *Kelleria regalis* Gurney and *K. purpurocincta* Gurney, as well as the previously described species *Pseudanthessius propinquus* T. Scott, from Loanda Harbour, Gulf of Guinea, and *P. pectinatus* A. Scott from the Malay Archipelago. Gurney defines the genus as follows: "General form and structure as in *Pseudanthessius* Claus. Mandible with margins strongly toothed. 2nd maxilla with 2nd joint not drawn out into a thread, but bearing large spines, some of which are toothed. Maxilliped in female three-jointed, stout, the 2nd and 3rd joints armed with large spines. Last joint of the 2nd antenna bearing setæ and two slender setiform claws. Endopod of leg 4 one-jointed, with inner lateral seta. Leg 5 one-jointed, movable."

In the present collections are three more species, all of which appear to be new.

Kelleria andamanensis sp. nov. (Text-fig. 9, A–I.)

Occurrence.—In Macpherson Strait, Andaman Islands: in the surface tow-net. A single female.

Descriptive Notes.—♀. Total length 0·8 mm.

The proportional lengths of the anterior and posterior regions of the body (Text-fig. 29, A) are as 3 to 2. The anterior margin of the cephalon is broadly rounded. The head and 1st thoracic segment are fused together with no indication of their line of demarcation. The three free thoracic segments of the anterior region, segments 2 to 4, rapidly diminish in size. The posterior region is comparatively slender. The proportional lengths of the segments of the posterior region are as follows:

Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
18	40	11	7	8	16 = 100

The anterior part of the genital segment is somewhat expanded, and the genital apertures in the dorso-lateral region are armed with a small spine anteriorly and a delicate seta posteriorly. Laterally on each side is a long serrated spine, about half the length of the segment, which projects backwards.

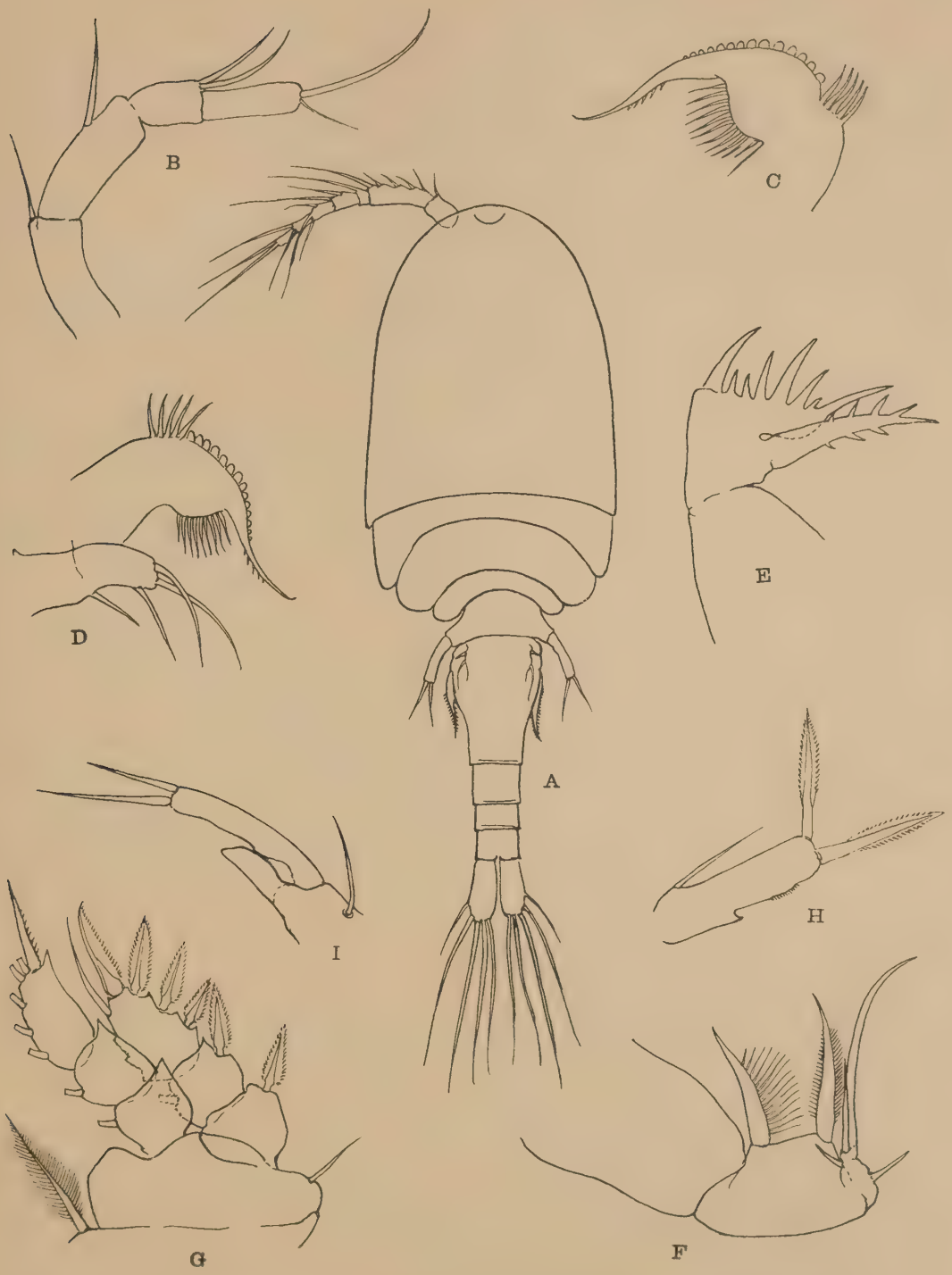
The furcal rami are twice as long as the anal segment and are about twice as long as broad; at the distal end they are somewhat tapered, so that two setæ appear to arise from the inner margin, one from the distal end and two from the outer border.

The 1st antenna consists of the usual seven segments, that have the following proportional lengths:

Segment 1.	2.	3.	4.	5.	6.	7.
16	32	7	12	11	11	11 = 100

It reaches back about half-way along the cephalic segment.

The 2nd antenna (Text-fig. 29, B) is composed of four segments of which the 1st and 2nd are the longest and the third and fourth together at least equal to either of the preceding segments; the 3rd segment is the shortest. Segment 3 bears a long slender



TEXT-FIG. 29.—*Kelleria andamanensis* sp. nov., ♀. A, Dorsal aspect. B, 2nd antenna. C, Mandible. D, Mandible and 1st maxilla. E, 2nd maxilla. F, Maxilliped. G, 1st swimming leg. H, Endopod of 4th swimming leg. I, 5th leg.

spine and a single seta, and the 4th segment bears distally a long curved, seta-like spine, but most of the setæ are wanting.

In the mandible (Text-fig. 29, C) the basal portion is somewhat swollen. Along the inner border there is first a group of five long spine-like teeth beyond which there is a row of some fourteen or fifteen rounded projections that diminish gradually in size. Along the outer border of the swollen basal part is a series of fine seta-like spines and along the middle of the terminal lash are four or five small teeth.

The 1st maxilla (Text-fig. 29, D) bears four setæ.

The 2nd maxilla (Text-fig. 29, E) exhibits the characteristic form of the genus; the basal part is well developed and the distal segment is armed along its border with a series of powerful teeth, while from the inner margin arises a stout spine, nearly as long as the distal part of the segment, that is armed along both margins with three or four spines. The whole organ is very like that of *Kelleria pectinatus* (A. Scott) (*vide* A. Scott, 1909, pl. lxviii, fig. 25).

The maxilliped (Text-fig. 29, F) is composed of three segments, of which the 1st is devoid of setæ; the 2nd segment carries two long and stout spine-like setæ, the proximal being fringed along the outer margin with long hairs, while the distal is fringed along both borders with short hairs. The distal segment is short and bears one long curved spine, one delicate one about half its length and two short and delicate ones. This appendage also bears a close resemblance to that of *Kelleria pectinatus* (A. Scott) (*cf.* A. Scott, 1909, pl. lxviii, fig. 26).

The swimming legs are of the usual type. The endopod of the 4th leg (Text-fig. 29, H) appears to be composed of a single segment, but its original double origin is indicated by a notch and a small spinous projection on the outer border: a single seta arises from the inner margin of the basal part and distally are two sub-equal spines.

The 5th leg (Text-fig. 29, I) consists of a basal part that bears a single seta on its outer aspect and at the distal inner angle is produced in a bluntly pointed prominence that extends nearly half-way along the inner side of the free segment; in this respect this appendage somewhat resembles that of *Kelleria pectinatus* (A. Scott) but the inner lobe of the basal segment is much longer in the present species. The free segment is long and bears two setæ distally.

Kelleria camortensis sp. nov. (Text-fig. 30, A–M.)

Occurrence:

Nankauri Harbour, Nicobar Islands; in weed-washings. Several females.

Addu Atoll, Maldive Archipelago; in weed-washings. One female and one male.

Descriptive Notes.—♀. Total length 1·0 mm.

The proportional lengths of the anterior and posterior regions of the body (Text-fig. 30, A) are as 3 to 2. The posterior border of the cephalon is faintly demarcated by a line across the dorsal aspect of the body and a groove laterally. The anterior margin of the cephalon is broadly rounded and the posterior thoracic segments taper gradually so that the outline of the whole anterior region is a smooth oval. The proportional lengths of the segments of the posterior region are as follows:

Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
14	37	11	9	11	18 = 100

TEXT-FIG. 30.—*Kelleria camortensis* sp. nov. A, Dorsal aspect, ♀. B, Dorsal aspect, ♂. C, 2nd antenna, ♂. D, Mandible and 1st maxilla, ♀. E, 2nd maxilla, ♀. F, 2nd maxilla, ♂. G, Maxilliped, ♀. H, Maxilliped, ♂. I, 1st swimming leg, ♂. J, 2nd swimming leg, ♂. K, 3rd swimming leg, ♂. L, 4th swimming leg, ♂. M, 5th leg, ♂.

The abdomen, with the exception of the genital segment that is swollen anteriorly, is comparatively slender. The genital segment is broad anteriorly and tapers gradually. The genital opening is guarded by a single delicate seta. The furcal rami are about one-and-a-half times as long as the anal segment and are two-and-three-quarters as long as broad : they are slightly divergent. The 2nd furcal seta is about equal in length to the whole abdomen.

The 1st antenna possesses seven segments that have the following proportional lengths :

Segment 1.	2.	3.	4.	5.	6.	7.
13	24	9	14	15	12	13 = 100

It reaches back about half way along the combined cephalon and 1st thoracic segment.

In the mandible (Text-fig. 30, D) the swollen basal part of the lash is fringed along its inner margin with a row of fine spines that are short proximally, but increase in size distally so that the distal five are twice the size of the more proximal spines. The biting edge is fringed with six strong claw-like spines proximally and a series of very small, needle-like, spinules distally.

The 1st maxilla bears four setæ, one on the lateral margin and three distally.

The 2nd maxilla (Text-fig. 30, E) consists of a strong basal segment and a distal joint, that is armed with a row of strong teeth of variable size and bears a stout seta that is armed with needle-like spines on both margins.

The maxilliped (Text-fig. 30, G) has the form characteristic of the genus : it consists of three segments, of which the 1st is devoid of setæ, the 2nd bears two strong, serrated, spine-like setæ and the terminal segment is armed with four stout setæ of which the 2nd is short and is serrated on both margins and the 3rd is about twice the length of the 1st and 4th.

The swimming legs have the form usual in the genus.

The 5th leg is comparatively small ; the free segment is somewhat swollen in its basal third and bears two setæ distally.

♂. Total length 1·04 mm.

The proportional lengths of the anterior and posterior regions of the body (Text-fig. 30, B) are as 7 to 6. The proportional lengths of the segments of the posterior region are as follows :

Th. 5.	Abd. 1.	2.	3.	4.	5.	Furca.
9	30	13	9	8	12	19 = 100

The genital segment is much swollen and is sub-globular in shape : in the postero-lateral region is a small swelling from which arises a single small seta. The furcal rami are one and a half times as long as the anal segment, but in this sex they are nearly four times as long as broad.

The 1st antenna is short and reaches back about half the length of the cephalic segment. As in the female it is composed of seven segments.

The 2nd antenna (Text-fig. 30, C) possesses the usual four segments. Of these the 2nd is the longest and is approximately equal to the last two together. The 3rd segment bears one slender curved spine and a single seta. The terminal segment carries three simple setæ and two geniculate spine-like setæ.

The 2nd maxilla (Text-fig. 30, F) has the usual form but the teeth bordering the biting edge are less well developed than in the female.

The maxilliped (Text-fig. 30, H) forms a powerful grasping organ. The upper margin of the " hand " is fringed with spines and a single seta arises near the proximal end. The distal segment or claw is long and slender, and is about twice the length of the " hand."

In the 1st leg (Text-fig. 30, I) the two rami are composed of three segments. The inner ramus shows no trace of the peculiar modification that Gurney found to be present

in the corresponding appendage of *Kelleria regalis* (*vide* Gurney, 1927*b*, fig. 116, E) : in this respect this species resembles *Kelleria propinquus* (T. Scott) and *K. purpurocincta* Gurney.

In the 2nd leg (Text-fig. 30, J) the 3rd segment of the endopod bears a short spine on the outer margin and two markedly unequal spines on the distal border, the outer spine being more than twice the length of the inner and nearly as long as the segment ; Gurney (1927*b*, p. 475, fig. 108, H) shows this appendage in *K. purpurocincta* as having a very small outer spine in this situation.

In the 4th leg (Text-fig. 30, L) the exopod is more slender than in the other appendages ; the endopod is composed of a single segment that bears an inner seta near the proximal end and two unequal spines distally.

The 5th leg (Text-fig. 30, M) has a short free segment that tapers slightly to the distal end, which bears two sub-equal setæ.

Although this species somewhat closely resembles *K. purpurocincta* Gurney and, clearly, is closely related to it, it appears to differ in certain details of structure, and I regard it as a different species.

Kelleria gurneyi sp. nov. (Text-fig. 31, A–H.)

Occurrence.—Kurau River, Perak, Federated Malay States : in surface tow-net. Two females.

Descriptive Notes.—♀. Total length 0·77 mm.

The proportional lengths of the anterior and posterior regions of the body (Text-fig. 31, A) are as 22 to 19. The cephalon and 1st thoracic segment are clearly demarcated by a suture across the dorso-lateral region. The head is broadly rounded anteriorly and the rostral plate projects vertically downwards. The postero-lateral angles of the 2nd, 3rd and 4th thoracic segments are produced backwards in sharply pointed processes and the lateral margin of the 2nd thoracic segment is crenated in the posterior half of its length. The 4th segment is produced in the mid-dorsal line in a rounded prominence that closely resembles the condition found in *Oncæa conifera* Giesbr. The proportional lengths of the segments of the posterior region are as follows :

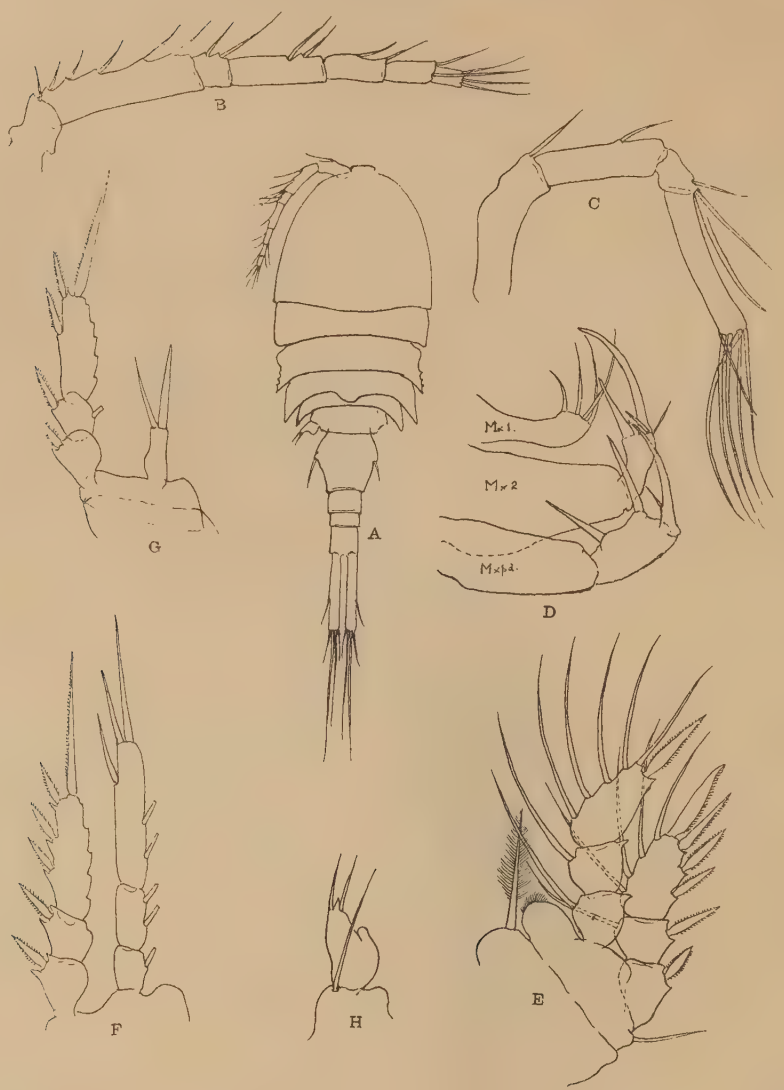
Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
11	27	9	6	13	34 = 100

The genital segment is moderately swollen anteriorly and at about the middle of its length on each side there is a small swelling, that bears a single seta : behind this the segment tapers gradually. The anal segment is twice the length of the immediately preceeding one. The furcal rami are very long and narrow and are a little over seven times as long as broad ; they are two and a half times the length of the anal segment : one small seta arises from the lateral margin a little beyond the middle of its length and four others arise from the distal end.

The 1st antenna (Text-fig. 31, B) reaches back to about three-fourths the length of the cephalon ; it consists of seven segments that have the following proportional lengths :

Segment 1.	2.	3.	4.	5.	6.	7.
17	35	6	14	12	10	6 = 100

The 2nd antenna (Text-fig. 31, C) is composed of four segments, of which the 4th is the longest and the 3rd the shortest, the 1st and 2nd being of approximately equal length : the 3rd segment bears a long and slender spine-like seta and two other delicate



TEXT-FIG. 31.—*Kelleria gurneyi* sp. nov., ♀. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, 1st and 2nd maxillæ and maxilliped. E, 1st swimming leg. F, 3rd swimming leg. G, 4th swimming leg. H, 5th leg.

smaller setæ, while the distal segment bears five long and delicate setæ and one much shorter one.

I was unfortunately unable to determine the character of the mandible.

The 1st maxilla (Text-fig. 31, D, Mx. 1) consists of the usual lobe, bearing four setæ.

The 2nd maxilla (Text-fig. 31, D, Mx. 2) appears to be unusual in character; it consists of the usual two segments but the distal segment is produced in a long curved claw that appears to be devoid of teeth, and from the inner border arises a spine about half the length of the claw, that also appears to have no spines or teeth.

The maxilliped (Text-fig. 31 D, Mxpd.) consists of the usual three segments, of which the 1st is devoid of setæ, the 2nd carries two straight spine-like setæ and the terminal segment bears one long slightly curved spine-like seta and a second, small delicate seta.

The anterior three pairs of swimming legs (Text-figs. 31, E and F) are of the usual type. The 4th leg (Text-fig. 31, G) possesses a three-jointed exopod ; the 3rd segment is equal in length to the combined 1st and 2nd segments and bears only two marginal spines. The end-spine is as long as the segment. The endopod consists of a single segment that is short and is devoid of a seta on its inner border, but bears at its distal end a stout spine that is somewhat longer than the whole ramus and a slightly shorter seta.

The 5th leg (Fig. 31, H) is composed of a basal portion that bears a single seta and a distal free segment that is produced about the middle of its length in a rounded prominence ; distally it bears two setæ between which there is a small spine-like prominence. The whole appendage closely resembles that of *Kelleria regalis* Gurney and *K. purpurocincta* Gurney.

I have much pleasure in dedicating this species to Dr. Robert Gurney.

General Notes.—Although this species was obtained in the Kurau River, Federated Malay States, it was associated in the tow-netting with the following species :

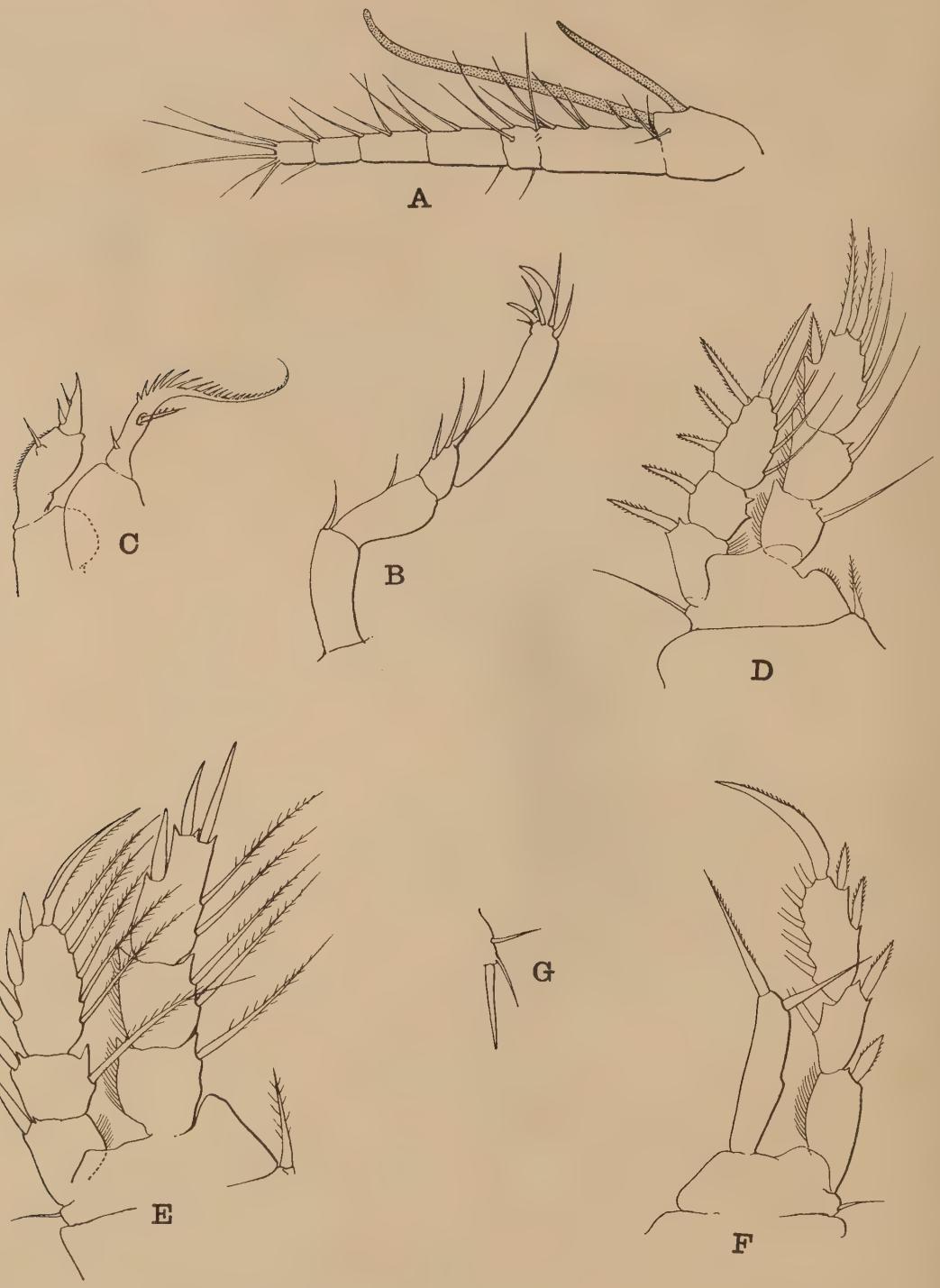
Eucalanus subcrassus Giesbrecht.
Paracalanus crassirostris Dahl.
Acrocalanus inermis Sewell.
A. gibber Giesbrecht.
Centropages kroyeri Giesbrecht.
Pseudodiaptomus aurivillii Cleve.
P. dauglishi Sewell.
P. mertoni Früchtl.
Temora stylifera (Dana).
T. turbinata (Dana).
Labidocera euchæta Giesbrecht.
L. kroyeri (Brady).
L. pectinata Thompson and A. Scott.
Acartia (*Odontacartia*) *erythræa* Giesbrecht.
A. (*O.*) *pacifica* Steuer, var. *mertoni* Früchtl.
A. (*O.*) *spinicauda* Giesbrecht.
Tortanus barbatus (Brady).
T. forcipatus (Giesbrecht).
Oithona brevicornis Giesbrecht.
O. nana Giesbrecht.
Corycæus (*Ditrichocoryeæu*) *subtilis* Dahl.
Microsetella norvegica Boeck.
Euterpina acutifrons (Dana).

It seems fair to assume that the general conditions were those of brackish water.

Genus *Pseudanthessius* Claus.

Pseudanthessius, Claus, 1889, p. 18 ; Sars, 1913–18, p. 166.

A number of species that were originally attributed to this genus have been recorded from Indian waters, but, as already mentioned, several of these have had to be trans-



TEXT-FIG. 32.—*Pseudanthessius liber* (Brady and Robertson), ♀. A, 1st antenna. B, 2nd antenna. C, 2nd maxilla and maxilliped. D, 1st swimming leg. E, 2nd swimming leg. F, 4th swimming leg. G, 5th leg.

ferred to other genera. Of those that actually belong to this genus, the following have been taken in this area :

Pseudanthessius liber (Brady and Robertson).
P. gracilis Claus.
P. concinnus Thompson and A. Scott. (? = *Lichomolgus thorelli* Brady and Robertson.)
P. obscurus A. Scott.
P. weberi A. Scott.
P. mucronatus Gurney.

Among the present collections are three species, one of which appears to be new.

Pseudanthessius liber (Brady and Robertson). (Text-fig. 32, A–G.)

Lichomolgus liber, Brady 1880, p. 44, pl. lxxxvi, figs. 1–13.
Pseudanthessius liber, Thompson and A. Scott, 1903, p. 277; Sars, 1913–18, p. 169, pl. xciv.

Occurrence.—Nankauri Harbour, Nicobar Islands; in washings from a species of short-spined, regular Echinoid. Numerous specimens.

Remarks.—The present specimens exhibit slight differences from the original account given by Brady (1880) and also from the description and figures given by Sars (1913–18, pl. xciv). Of these differences the most marked are in the 2nd swimming leg (Text-fig. 32, E) in which the terminal spine of the present examples exhibits a marked inward curve, and the 3rd segment of the endopod appears to have only two setæ on the inner margin instead of three. The same inward curve is to be seen in the terminal spines of the exopods of the 3rd and 4th legs. In the 4th leg (Text-fig. 32, F) the endopod exhibits a slight notch in the outer border about half-way along the length of the segment and the outer of the two terminal spines is considerably larger than is figured by either Brady or Sars. These differences, in my opinion, hardly justify the creation of a new species and I have regarded these specimens as variations from the European type.

Distribution.—Nicobar Islands (present record), the Pearl Banks of Ceylon (Thompson and A. Scott), the British Isles (Brady, Norman and T. Scott) and the coast of Norway (Sars).

Pseudanthessius obscurus A. Scott. (Text-fig. 33, A–I.)

Pseudanthessius obscurus, A. Scott, 1909, p. 270, pl. lxix, figs. 8–14.

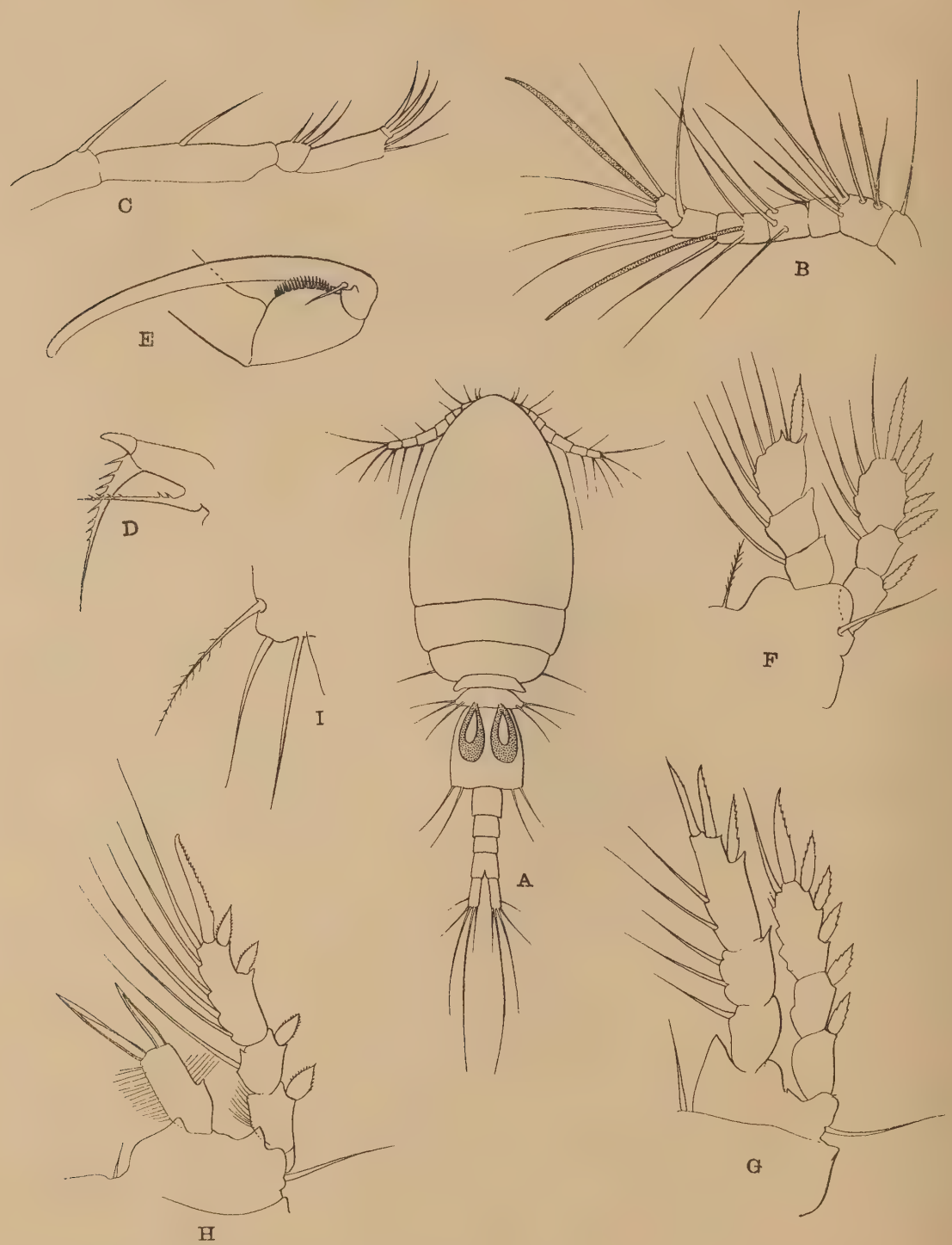
Occurrence.—Nankauri Harbour, Nicobar Islands; in weed-washings. One male.

Descriptive Notes.—♂. Total length 0·84 mm.

This is somewhat smaller than Scott's examples of the female, which measured 1·15 mm. The proportional lengths of the anterior and posterior regions of the body (Text-fig. 33, A) are as 57 to 43. The anterior region is oval in outline and is comparatively slender. The head and 1st thoracic segment are fused together. The 4th thoracic segment is very small, being only a little more than half the length of the 3rd segment. The proportional lengths of the segments of the posterior region of the body are as follows :

Th. 5.	Abd. 1.	2.	3.	4.	5.	Furca.
10	37	12	11	7	11	12 = 100

The genital segment is large and is dilated : two delicate setæ arise from the postero-lateral angles. The posterior segments are comparatively slender. The furcal rami are



TEXT-FIG. 33.—*Pseudanthessius obscurus* A. Scott, ♂. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, 2nd maxilla. E, Maxilliped. F, 1st swimming leg. G, 3rd swimming leg. H, 4th swimming leg. I, 5th leg.

as long as the 2nd abdominal segment and very slightly longer than the 3rd or the anal segments : they are nearly two and a half times as long as broad. The 2nd furcal seta is equal in length to that part of the abdomen behind the genital segment.

The 1st antenna (Text-fig. 33, B) is comparatively short and stout and reaches back only one half the length of the cephalon : it consists of the usual seven segments. A long and slender sensory filament arises from the middle of the 5th segment and a second one springs from the distal extremity of the seventh segment.

The 2nd antenna (Text-fig. 33, C) is slender and is composed of four segments of which the 3rd is very short and the 2nd is twice the length of the 4th. The terminal segment bears at its distal end three slender curved spines and two setæ.

I was unable to examine the mandible.

The 2nd maxilla (Text-fig. 33, D) is armed at the base of the biting flagellum with a very large triangular spine, as in the female (*cf.* A. Scott, 1909, pl. lxix, fig. 12).

The maxilliped (Text-fig. 33, E) forms a powerful claw ; the hand is comparatively short and is fringed along the anterior margin with a row of needle-like spines ; the dactylus is about three times the length of the hand and is slightly dilated distally.

The swimming legs are of the usual type ; in the 4th leg (Text-fig. 33, H) the 3rd segment of the exopod bears only two marginal spines and the endopod consists of a single segment that is equal in length to the 1st and 2nd segments of the exopod together ; there is a well-marked notch in the outer margin and the two terminal spines are of unequal size. The 5th leg (Text-fig. 33, I) is rudimentary and is represented by an expansion of the lateral margin of the 5th thoracic segment, which bears a long slender spine and two setæ.

Remarks.—The close agreement between this specimen and the description given by A. Scott (1909) of the female *P. obscurus*, seems to me sufficient to warrant referring this male specimen to the same species.

Distribution.—The Malay Archipelago (A. Scott) and the Nicobar Islands (present record).

Pseudanthessius gracilioides sp. nov. (Text-fig. 34, A–F.)

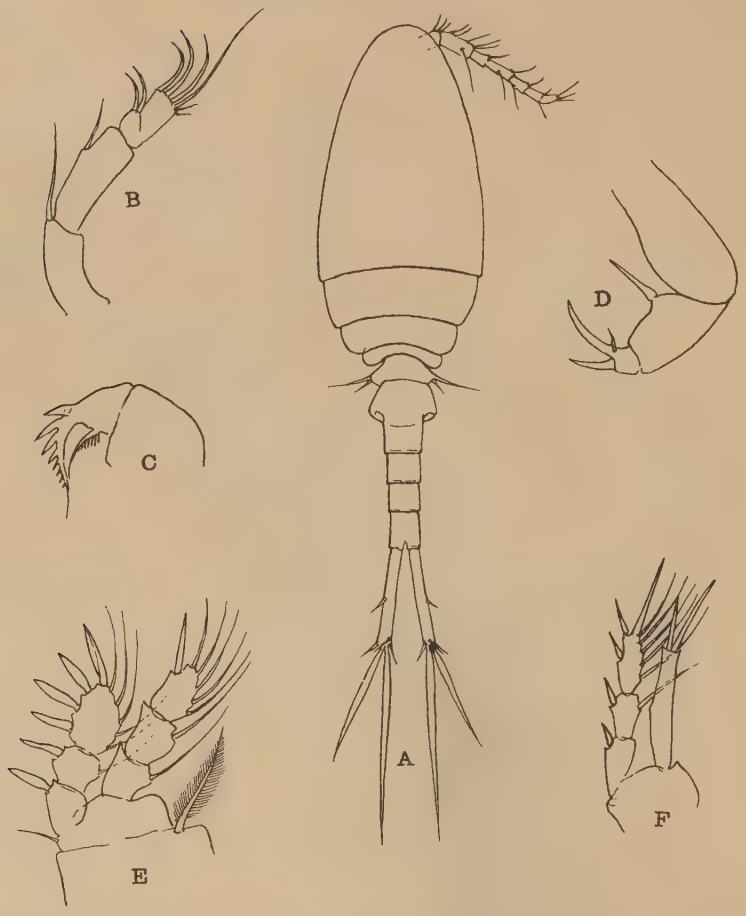
Occurrence.—Addu Atoll, Maldive Archipelago ; in weed-washings. One female.

Descriptive Notes.—♀. Total length 0·65 mm.

The proportional lengths of the anterior and posterior regions of the body (Text-fig. 34, A) are as 51 to 49. The anterior region forms a slender oval, more slender than Claus (1889, pl. iv, fig. 1) and Sars (1913–18, pl. xciii) figure *P. gracilis* Claus, and more nearly resembling *P. sauvagei* Canu. The head and 1st thoracic segment are fused together, and the posterior thoracic segments decrease in size, the 4th being less than half the length of the 3rd. The proportional lengths of the segments of the posterior region of the body are as follows :

Th. 5.	Abd. 1–2.	3.	4.	5.	Furca.
6	32	10	9	12	31 = 100

The genital segment is markedly swollen in the anterior half of its length and then narrows abruptly. The following segments are slender. The furcal rami are two and a half times as long as the anal segment and about six and a half times as long as broad. The 2nd and 3rd furcal setæ are thickened and spine-like ; the 2nd is a little longer than the com-



TEXT-FIG. 34.—*Pseudanthessius gracilioides* sp. nov., ♀. A, Dorsal aspect. B, 2nd antenna. C, 2nd maxilla. D, Maxilliped. E, 1st swimming leg. F, 4th swimming leg.

bined lengths of the last three abdominal segments plus the furcal rami, and the 3rd is about two-thirds the length of the 2nd. The other furcal setæ are small and delicate.

The 1st antenna reaches back about half-way along the cephalic segment; its seven segments have the following proportional lengths:

Segment	1.	2.	3.	4.	5.	6.	7.	
Present specimen	13	23	9	16	17	13	9 = 100	
P. gracilis Claus	12	24	9	16	17	12	10	from Claus (1889)
	(7)	(14)	(5)	(9)	(10)	(7)	(5·5)	

For convenience of reference I have also given (in brackets) the lengths of the segments in *P. gracilis* Claus, as given by Claus, and the corresponding lengths in parts per 100 of the total length of the appendage. It is thus clear that there is little or no difference between Claus' species and the present example.

The 2nd antenna (Text-fig. 34, B) is composed of four segments, of which the 3rd and 4th are quite short and are together considerably less than either the 1st or the 2nd segment. The 3rd segment bears a curved spine and two setæ; the 4th segment has three curved spines and one long seta together with several shorter ones.

I was unable to examine the mandible.

In the 2nd maxilla (Text fig. 34, C) the terminal segment bears a basal spine that is serrated on one side only, and the terminal lash is armed with teeth that decrease in size distally ; the first tooth is considerably more stout than those which immediately follow. The maxilliped (Text-fig. 34, D) is composed of three segments ; the 2nd bears a single well-developed spine about half-way along its length, and the terminal segment is produced in a spinous process that is considerably longer than the process in *P. gracilis* Claus : on its outer side there is a spine that is more than half the length of the process and from the inner aspect arises a small seta. The general form of the appendage is an approximation to the condition found in the genus *Kelleria*.

The swimming legs closely resemble those of *P. gracilis* Claus. The 4th legs (Text-fig. 34, F) are slender and consist of a three-jointed exopod and a one-jointed endopod ; the two rami are of very nearly equal length, the endopod reaching to about three-quarters the length of the 3rd segment of the exopod, whereas in *P. gracilis* it only reaches a little beyond the 2nd segment of the outer ramus. The 3rd segment of the exopod bears only two marginal spines, and the endopod bears distally two spines, of which the outer is about half the length of the inner.

The 5th leg is represented by a spine and a seta that is about half its length.

Remarks.—In its general characters this species comes very near to *P. gracilis* Claus, but it is a more slender form and differs in certain details of structure, such as the greater length of the endopod of the 4th leg and the flattened and spine-like furcal setæ.

Genus *Nasomolgus* gen. nov.

A single female example that differs in certain characters from all other members of the family was taken at Station 45. These differences are so marked that I propose to create a new genus and species for the accommodation of this specimen.

Generic Characters.—The chitinous covering is strongly developed. The cephalon and 1st thoracic segment are fused. The rostrum is extremely well developed and forms a racquet-shaped mass, that is produced backwards in the middle line and terminates in a stout sharply-pointed spine. The 1st antenna is composed of the usual 7 segments. The 2nd antenna forms a well-developed and strongly chitinized grasping organ ; it is composed of four segments, of which the 3rd is very short and the terminal segment bears two recurved hook-like spines. So far as I am able to determine without dissecting the unique specimen the mouth-parts resemble those of other genera in the family. The mandible is a pear-shaped plate with a finely serrated margin. The 1st maxilla is represented by a small palp that appears to bear only two short setæ, as in *Lichomolgella*. The maxilliped is unlike that of any other member of the family : the terminal segment is slender and bears a long curved spine. The setal formula is as follows :

	Endopod.				Exopod.								
	1.	2.	3.		1.		2.		3.				
	Si.	Se.	Si.	Se.	Si.	Se.	Si.	Se.	Si.	St.	Se.		
P1	1	1	5,	I	0	I	1	I	4	I	II		
P2	1	2	3,	III	0	I	1	I	5	I	III		
P3	1	2	2,	III	0	I	1	I	5	I	II		
P4	1	II			0	I	1	I	5	I	II		

The endopod of the 4th leg is composed of two segments, of which the proximal bears an inner seta and the distal carries two unequal spines at the distal end, as in the genus *Macrochiron*.

The 5th leg closely resembles that of *Pseudanthessius*. The free segment is minute and bears two sub-equal setæ.

Nasomolgus cristatus sp. nov. (Text-fig. 35, A–E).

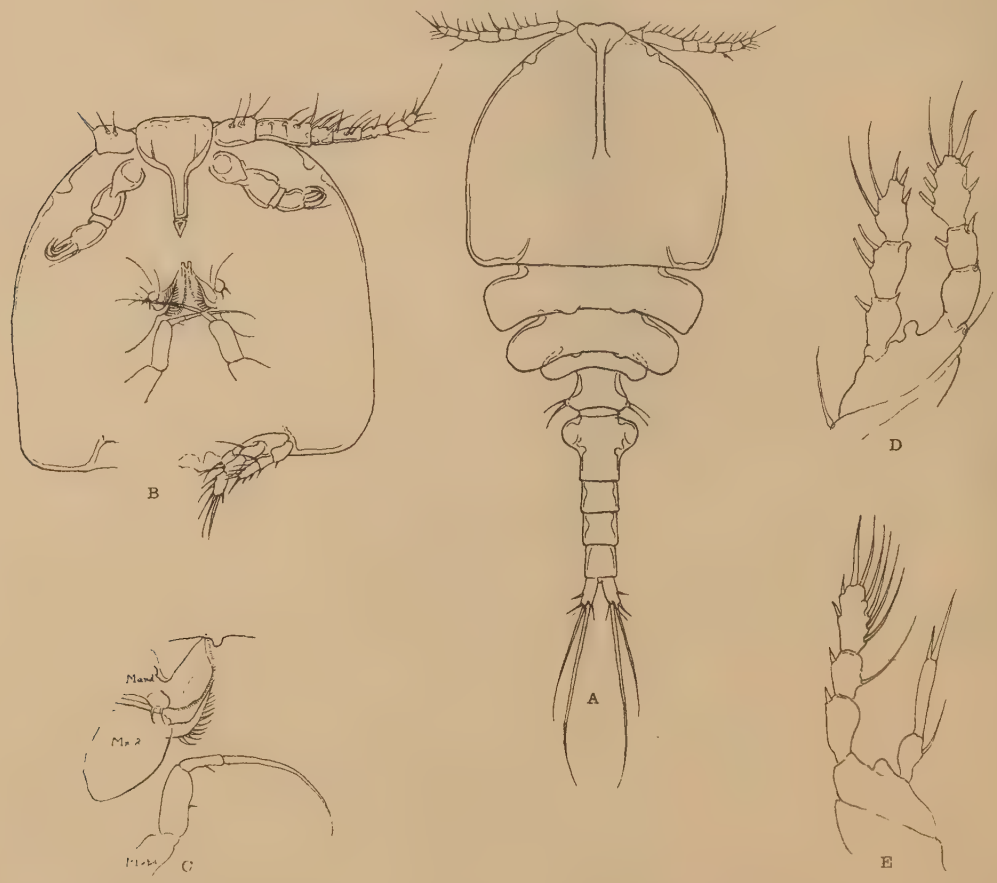
Occurrence.—Station 45, South Arabian Coast, depth 38 m. in debris. One female.

Descriptive Notes.—♀. Total length 0·85 mm.

The general shape is of the usual cyclopoid type. The anterior and posterior regions (Text-fig. 35, A) have the proportional lengths of 60 to 40. The proportional lengths of the various segments of the body are as follows :

Cephalon-Th. 1.	Th. 2.	3.	4.	5.	Adb. 1–2.	3.	4.	5.	Furca
450	68	68	31	54	117	54	54	54	50 = 1000

The fused cephalon and 1st thoracic segment is about as long as broad, and a strong chitinous crest runs backwards in the mid-dorsal line for about half the length of the segment.



Text-fig. 35.—*Nasomolgus cristatus* sp. nov., ♀. A, Dorsal aspect. B, Ventral aspect of cephalothorax. C, Mouth-parts *in situ*. D, 3rd swimming leg. E, 4th swimming leg.

The postero-lateral margin of the segment is strongly chitinized. The lateral borders of the 2nd and 3rd thoracic segments are produced and rounded, and the chitin is thickened along the antero-lateral border ; the posterior margins of these segments is produced in a small prominence on either side of the mid-dorsal line. The 4th thoracic segment is small.

The 5th thoracic segment is well developed, and the chitin is thickened around the anterior two-thirds of the segment. The genital segment, composed of segments 1 and 2 fused together, is dilated in the anterior half, and the chitin is thickened at the antero-lateral angle and around the front part of the narrow hind portion of the segment. The 3rd, 4th and 5th segments are of equal length and the chitin is thickened around the middle portion of segments 3 and 4 and the anterior half of segment 5. The furcal rami are slightly divergent, and are about two and a half times as long as broad : each bears six setæ, of which the 2nd is nearly as long as the whole posterior region. The external marginal seta is small, and arises at about the junction of the middle and distal thirds.

The 1st antenna is composed of the usual 7 segments, that have the following proportional lengths :

Segment 1.	2.	3.	4.	5.	6.	7.
15	30	11	15	15	8	6 = 100.

The 2nd antenna forms a powerful grasping organ, and is composed of four segments of which the 3rd is very short. The chitin of the segments is thickened, and the distal segment bears distally two well-developed hook-like spines and a single seta.

The mandible (Text-fig. 35, C, Mand.) is, as in other species of the family, a rasping organ.

The 1st maxilla is small, and bears two short setæ.

The 2nd maxilla has a terminal lash that bears a row of about twelve needle-like spines, of which the 1st or proximal is somewhat larger than the others.

The Maxilliped (Text-fig. 35, C, Mxpd.) is composed of three segments, of which the proximal two are moderately well developed, and the 3rd is slender and rod-like and bears distally a long delicate curved spine, that is as long as the three segments together. A single small seta arises from each of the 2nd and 3rd segments about the middle of their length.

In the 1st swimming leg, both rami are composed of three segments.

In the 4th swimming leg (Text-fig. 35, E) the endopod is composed of two segments, and reaches to the end of the 2nd segment of the exopod. The proximal segment is slightly dilated, and bears a single seta on its inner border ; the distal segment is slender and rod-like, and carries two unequal spines at the distal end.

The 5th leg is markedly reduced, and the free segment is minute : it bears two subequal setæ.

MONSTRILLOIDEA.

Section I. Cycloipmorpha.

Family Thespesiopsyllidæ.

Sars (1921, pp. 4–6) created a special subsection of the Monstrilloidea, the Cyclopimorpha, to accommodate his newly created family Thaumatopsyllidæ, with its single genus *Thaumatopsyllus* Sars, which includes a single species *T. paradoxus* Sars. Wilson (1932,

p. 604, footnote) has, however, pointed out that the generic name *Thaumatopsyllus* is preoccupied, having been used by T. Scott (1894) as a synonym of the genus *Ægisthus*. He proposed the substitution of the name *Thespesiopsyllus* for *Thaumatopsyllus*, and in consequence, the name of the Family must be changed to Thespesiopsyllidæ (*vide* Wilson, 1932*a*, p. 393).

Thespesiopsyllus paradoxus (Sars) is an extremely rare form that has been taken in only two localities on the Norwegian coast, and up to the present time only three examples, all females, have been secured. A second form that appears to fall into the same family, though belonging to a different genus, has been taken by the " Investigator " in Indian waters.

Orientopsyllus gen. nov.

Generic Characters.—The general shape of the body is distinctly cyclopimorph, and is similar to that of *Thespesiopsyllus paradoxus* (Sars). The anterior region is moderately robust, and is oval in shape, while the posterior region is elongate and very slender. The head and 1st thoracic segment are separate. The 4th thoracic segment in this genus forms part of the anterior region of the body, only the 5th thoracic segment being reduced in size and incorporated in the posterior region. The abdomen is composed of three segments, but the 1st and 2nd are only partially separated; the 3rd segment is very slender, elongate and rod-like. The furcal rami are well developed and bear the normal six setæ, five marginal and one small dorsal accessory seta. The anterior antennæ are composed of only a small number of segments. I could detect no trace of a 2nd antenna or any mouth-parts. Five pairs of thoracic appendages are present; of these, only the anterior three pairs are natatory, and are composed of the usual two rami, each ramus having three segments. The 4th and 5th pairs of legs are reduced.

The differences between this new genus and *Thespesiopsyllus* can best be seen from the following table:

Table.

Thespesiopsyllus Wilson (= *Thaumatopsyllus* Sars).	*Orientopsyllus* gen. nov.
The body cyclopoid in shape; the anterior region dilated, and the posterior region slender and attenuate.	Ditto.
Head and 1st thoracic segment fused.	Head and 1st thoracic segment separate.
Thoracic segments 4 and 5 forming part of the posterior region of the body.	The 4th thoracic segment forming part of the anterior region, and only the 5th thoracic segment included in the posterior region.
Abdomen composed of three separate segments, the 3rd very slender and rod-like.	The abdomen composed of two free segments, the 1st and 2nd being only partially separate; the posterior segment slender and rod-like.
Furcal rami well developed with the normal 6 setæ.	Ditto.

TABLE—*continued*.

Thespesiopsyllus Wilson (= *Thaumatopsyllus* Sars)	*Orientopsyllus* gen. nov.
The anterior antenna composed of 9 segments.	The anterior antenna composed of 6 segments.
No trace of 2nd antenna and mouth-parts observed.	Ditto.
Three pairs of natatory legs present; the posterior two pairs reduced.	,,
The 4th and 5th pairs of legs uniramous.	,,
The 5th pair of legs composed of three segments.	The 5th leg composed of a single segment.

The inclusion of only the last thoracic segment in the posterior region of the body ranges this genus with Giesbrecht's Podoplea, and forms a connecting link between the Podoplea and the Monstrilloida. The reduction of the 4th thoracic segment and its inclusion in the posterior region in *Thespesiopsyllus* approximates that genus to the Families Artotrogidæ and Cancerillidæ of the Cyclopoida.

Orientopsyllus investigatoris sp. nov.

OCCURRENCE.—Nankauri Harbour, Nicobar Islands; in the surface tow-net. Two females.

DESCRIPTIVE NOTES.—♀. Total length 1·82 mm.

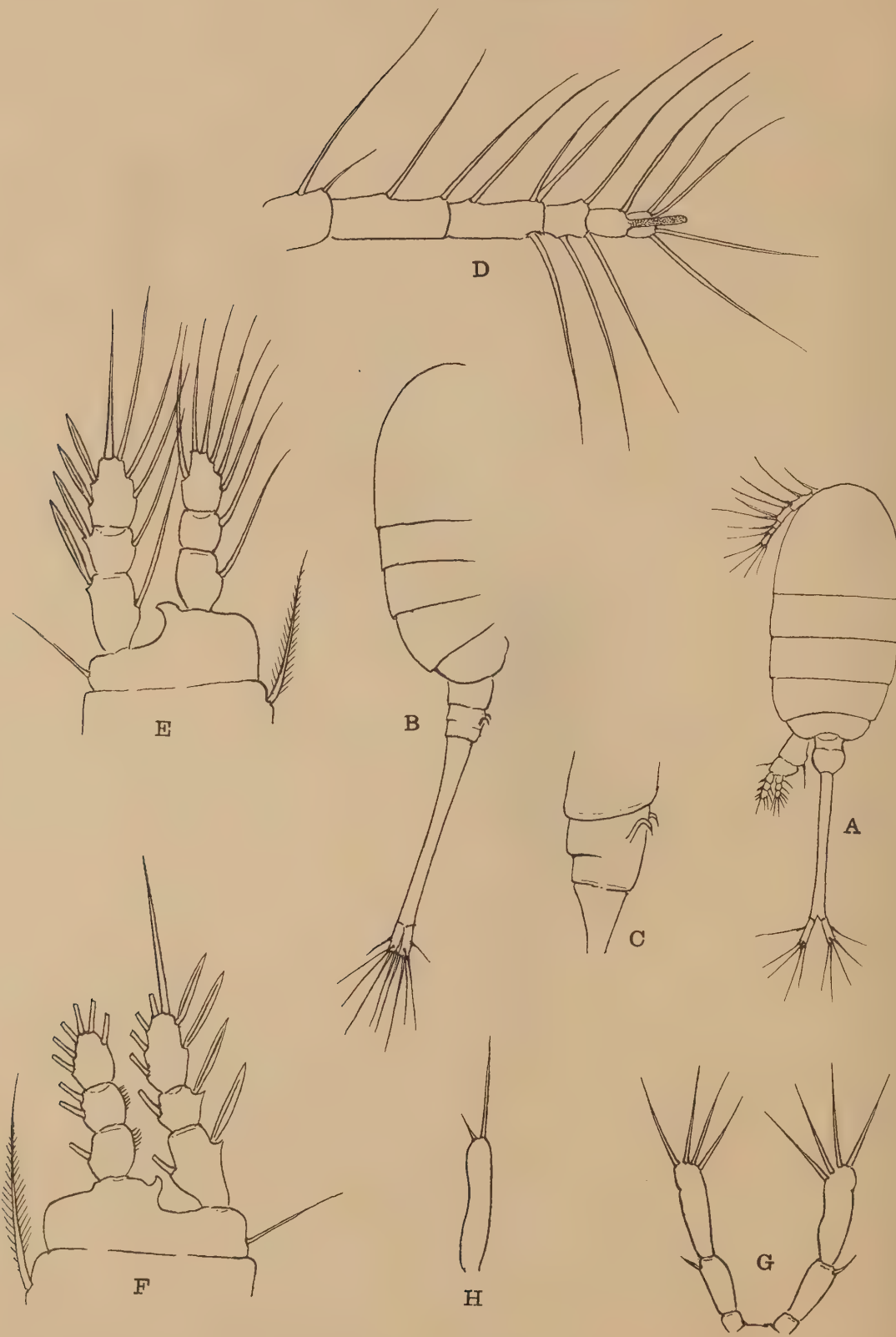
The proportional lengths of the anterior and posterior regions differ very slightly in the two specimens, being 51 to 49 in one and 53 to 47 in the other. The anterior region forms a regular oval and the 4th thoracic segment is somewhat reduced in size and has uniformly rounded postero-lateral margins. The posterior region of the body is very slender, and the various segments of which it is composed have the following proportional lengths:

Th. 5.	Abd. 1.	2.	3.	Furca.
11	6	6	61	16 = 100

The 1st anterior segment of the abdomen is short, and the line of separation between it and the next segment appears to be incomplete ventrally. The segment is only slightly expanded, and on its ventral aspect it bears a pair of curved hook-like "egg-setæ." The posterior abdominal segment is five times the combined length of the preceeding segments, and is slightly expanded at its posterior end, where the furcal rami are articulated. The furcal rami are two and a half times as long as wide, and are slightly divergent. Each ramus bears a seta about half-way along the outer margin, four setæ, of approximately equal length, on the distal end and a small accessory seta on the dorsal aspect.

The 1st antenna is short and only reaches back a little more than half the length of the cephalon. It is composed of only six segments, that have the following proportional lengths:

Segment 1.	2.	3.	4.	5.	6.
15	31	22	9	10	13 = 100



TEXT-FIG. 36.—*Orientopsyllus investigatorus* sp. nov., ♀. A, Dorsal aspect. B, Lateral aspect. C, Genital segment. D, 1st antenna. E. 1st swimming leg. F, 3rd swimming leg. G, 4th pair of legs. H, 5th leg.

The 5th segment bears a sensory filament that is about twice as long as the end-segment.

I was unable to discover any trace of a 2nd antenna or of any mouth-parts.

The anterior three pairs of legs are well developed, and are natatory in function. Each leg consists of the usual two-jointed basal portion and two rami, each of three segments. Basal 1 bears an inner seta. Basal 2 carries an outer seta and the distal margin between the attachment of the rami is produced in a short hook-like process, directed outwards. In the exopod of the 1st leg, the proportional lengths of the segments and the end-spine are as 20, 9, 16, 36. Exopod 1 and 2 each bear a single inner seta and an external marginal spine, that is about as long as the segment itself. Exopod 3 bears two equal marginal spines, a long and slender end-spine, and carries three setæ on the inner margin in the 1st leg and 4 in the 2nd and 3rd. The endopod has a single seta on segments 1 and 2, and 6 setæ on segment 3. There are 2 setæ on endopod 2 in the 2nd and 3rd legs.

The 4th legs are uniramous, and are composed of three segments, of which the proximal is small; the 2nd, about twice as long, bears a single delicate needle-like spine near the distal outer angle, and the terminal segment is equal in length to the other two and bears 4 setæ distally.

The 5th leg is reduced to a single segment, and bears distally two spines of markedly unequal length.

Section II. Monstrilloida genuina.

Family Monstrillidæ.

In this family, the first genus to be created was *Monstrilla* Dana (1848), and a year later Kröyer created *Thanmaleus* (1849). Giesbrecht (1892) recognized both these genera, and attempted to define them, but the species that he grouped together under the generic name *Thaumaleus* are not, as Sars (1921) has pointed out, congeneric with Kröyer's species and, if *Thaumaleus* is to be recognized as a distinct genus, it must be confined to Kröyer's species. Thompson (1888) had already described a species that is clearly congeneric with Giesbrecht's species, and he had created the genus *Cymbasoma* to accommodate it. Malaquin (1896) created a third genus, *Hæmocera*. Van Breemen (1908, p. 202) has pointed out that it is almost impossible to classify the species that were then known into clearly separate groups or genera, and Sars (1921) treats the genus *Hæmocera* Malaquin as a synonym of *Cymbasoma* Thompson, but creates a further genus *Monstrillopsis* to accommodate a single, slightly aberrant species, *Monstrillopsis dubia* (T. Scott). Malaquin (1901, p. 108) has given a Table in which he has attempted to show the similarities and differences between the genera *Cymbasoma* Thompson (= *Thaumaleus* Giesbrecht), *Monstrilla* Dana and *Hæmocera* Malaquin, and I reproduce this in a somewhat expanded form (see Table, p. 132).

As Malaquin (1901, p. 108) has pointed out, the only characters that appear to be of any use in separating the different genera are the number of segments in the abdomen of the female, and the number of setæ that arise from the furcal rami, but, as the Table shows, the former only serves definitely to separate the genus *Cymbasoma*, in which there are only two segments, and certain species of *Monstrilla* in which there are four, from all the rest, whereas the latter merely serves to separate the females and the males of certain species of the genus *Monstrilla*, in which there are 5 or 6. The presence of a vestigial 5th pair of feet in the male also separates the species of *Monstrilla* from all the others.

TABLE.

		Monstrilla Dana.	*Monstrillopsis* Sars.	*Haemocera* Malaquin.	*Cymbasoma* Thompson.
Number of abdominal segments	♀	3 or 4	3	3	2
	♂	4	4	4	3
Number of furcal setæ	♀	5 or 6	4	3 or 4	3 or 4
	♂	4 to 6	4	3 or 4	3 or 4
Situation of mouth		About the middle of cephalothorax	Far in front of the middle of the cephalothorax	As in *Monstrillopsis*	As in *Monstrillopsis*
Number of segments in 1st antenna	♀	4 or 5, but in several species segments 2 to 5 are fused	4	4	3 or 4
	♂	5	5	5	5
5th pair of thoracic legs in	♂	Represented by a pair of long setæ	Absent	Absent	Absent
Eyes		Usually imperfectly developed	Well developed	Well developed	Well developed
In addition to the above characters Malaquin gives—					
Appendage of the genital segment	♂	Little developed	Well developed	Well developed	Well developed

but the later discovery of other males indicates that this no longer holds good.

One of the chief characters used by Sars for the separation of *Monstrillopsis* from the other genera is the structure of the 5th leg of the female, to wit: "Last pair of legs, however, in female of rather a peculiar structure, being somewhat fusiform in shape, and each produced into 2 smooth conical lappets, the outer of which is the more prominent; setæ of these legs not, as usual, attached to the terminal edge of the leg, but arranged on a line crossing the base of the outer lappet." A comparison of the figures of this leg in *Monstrillopsis dubia* (T. Scott) as given by Sars (1921, pl. xiv) with those of *Cymbasoma gracile* Gurney (1927, fig. 28, B), and of *C. longispinosa* (Bourne) (1890, pl. xxxvii, fig. 10) shows that in all these species, the 5th legs exhibit this character and hence it cannot be used to distinguish *Monstrillopsis* from the other genera unless we are prepared to transfer both these last mentioned species to Sars' new genus. If the differences between *Monstrillopsis dubia* (T. Scott) and all other species in the group are sufficient, as suggested by Sars, to warrant the creation of a special genus for its accommodation, I can see no reason for refusing to recognize the genus *Hæmocera* as distinct from *Cymbasoma*.

Genus *Monstrilla* Dana.

A number of species have been referred to this genus and *inter se* exhibit a very considerable range of variation. Sars (1921, p. 10) gives as one of the characters of the genus, "Caudal rami sublamellar, each provided in female with 5 or 6 setæ, one of which is generally shorter than the others and attached more dorsally; those in male of same appearance as in female, but lacking one of the setæ." This last statement, however, only appears to hold good for certain species, namely:

Monstrilla longicornis Thompson,
M. longiremis Giesbrecht,
M. leucopis Sars,

and perhaps also in *Monstrilla conjunctiva* Giesbrecht, if I am right in attributing a hitherto unknown female to that species, which was described from the male only. In these four, the female has 5 setæ and the male only 4; but in *Monstrilla grandis* and possibly in *M. anglica* there are 6 setæ in both sexes.

Sars (*loc. cit.*) also gives as one of the characters of this genus that the 5th pair of legs in the female is "sublamellar and somewhat extended laterally, inner edge more or less expanded, extremity slightly exserted and provided with 3 (in some cases only 2) plumose setæ." Here, too, however, we find a great range of variation. In a few species the inner margin is somewhat expanded, but is devoid of a seta, as in *Monstrilla helgolandica* Claus, *M. leucopis* Sars and *M. longipes* A. Scott, while the distal end bears only 2 setæ. In others, as *M. gracillicauda*, the distal end bears 3 setæ. In others again we find that the inner expansion bears a single seta and the distal end 3, as in *Monstrilla longicornis* Thompson, *M. longiremis* Giesbrecht and *M. clavata* Sars. Finally, in other species there is a definite prolongation of the inner margin into a definite lappet, similar to that found in the genus *Cymbasoma*, and this lappet bears either 1 seta, the outer ramus bearing 3, as in *Monstrilla turgida* A. Scott and *M. inserta* A. Scott, or 2 setæ, as in *M. cymbula* A. Scott, *M. orcula* A. Scott, and *M. grandis* Giesbrecht.

In the majority of species the female possesses a 1st antenna that is primarily composed of 5 segments; but in certain species only the 1st or proximal segment is actually defined, all the other four being fused into one: such a condition is found in *Monstrilla longicornis* Thompson, *M. longiremis* Giesbrecht, *M. leucopis* Sars, *M. clavata* Sars, and, if I am correct in attributing a female in the present collection to *M. conjunctiva* Giesbrecht, then in that species also. In *M. anglica* Lubbock, according to T. Scott, the proximal two segments are defined, and in *M. grandis* Giesbrecht and *M. gracillicauda* Giesbrecht the first three are separate, and only the 4th and 5th segments are fused, exactly as they are in the genera *Cymbasoma* Thomp., *Hæmocera* Malaquin and *Monstrillopsis* Sars. In certain species, namely *Monstrilla longicornis* Thomp., *M. longiremis* Giesbr. and *M. clavata* Sars, certain of the setæ on the 1st antennæ are dichotomous in character. Bourne (1890, p. 568, pl. xxxvii, fig. 6) has described and figured such dichotomous setæ on the terminal segment of *Monstrilla anglica* Lubbock, but in a specimen that I believe to belong to this species, no such setæ were noticed. It is possible that this dichotomous branching is not a normal character, for similar setæ have not infrequently been recorded in several species belonging to different genera of the Calanoida. I have myself found them to be present in:

Canthocalanus pauper (Giesbr.).
Undinula vulgaris (Dana).
Paracalanus aculeatus Giesbr.
Acrocalanus longicornis Giesbr.
Calocalanus pavo (Dana).
Euchirella bella Giesbr.
Euchirella curticauda Giesbr.
and *Xanthocalanus greeni* Farrar.

In all the above, these dichotomous setæ were situated on the furcal rami, but in one specimen of *Acrocalanus longicornis* a similar seta was found growing from the end of a damaged 1st antenna, and I have (Sewell, 1914, p. 196) suggested that the condition

may be produced by damage to a normal seta and subsequent regeneration in an abnormal form.

The genus *Monstrilla* appears to be well represented in Indo-pacific waters. Dana recorded *Monstrilla viridis* from the Sulu Sea. A. Scott (1909), in his report of the "Siboga" collections in the Malay Archipelago, recorded the presence of *Monstrilla gracillicauda* Giesbrecht, *M. longicornis* Thompson and *M. helgolandica* Claus, previously known from European waters, and, in addition, described five new species, namely *M. orcula*, *M. inserta*, *M. cymbula*, *M. longipes* and *M. turgida*. Gurney (I927) has recorded yet another European species, *M. grandis*, from the Suez Canal, and in the present collections are examples of *M. helgolandica* Claus, *M. anglica* Lubbock, *M. longipes* A. Scott, previously known only from the Malay region, and what I believe to be the unknown female of *M. conjunctiva* Giesbrecht, that was described and recorded, from the male sex only, from the Antarctic. As Gurney (1927, p. 168) has pointed out, examples are so rarely taken that very little is known of the distribution, but the presence of such species as *M. longicornis*, *M. gracillicauda* and *M. grandis* in both European and Indo-Pacific waters suggests that they have a wide range.

Monstrilla anglica Lubbock. (Text-fig. 37, A–C).

Monstrilla anglica, Lubbock, 1857, p. 409, pl. x, figs. 7, 8 ; Bourne, 1890, p. 576, pl. xxxvii, figs. 5, 7 and 9 ; van Breemen, 1908, p. 209, fig. 221, *a* and *b*.
(*Not Monstrilla anglica*, T. Scott, 1904.)

Occurrence.—Nankauri Harbour, Nicobar Islands ; in surface tow-net. One male.

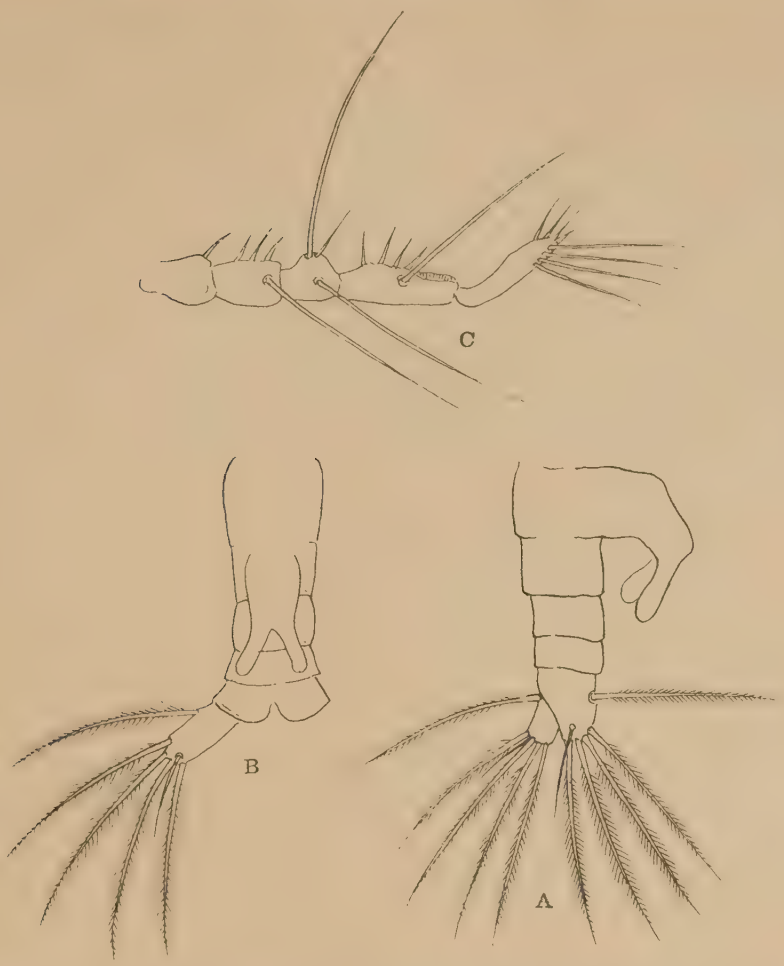
Descriptive Notes.—♂. Total length 1·27 mm.

This is only very slightly smaller than Lubbock's example that measured 1·3 mm. The proportional lengths of the anterior and posterior regions of the body are as 76 to 24. The abdomen (Text-fig. 37, A, B) consists of 4 segments. The genital segment bears a well-developed appendage that bifurcates distally into two branches that are bent sharply backwards, and are bluntly rounded at their apices. They reach back to about the middle of the 3rd segment. The furcal rami are about twice as long as broad, and are widely divergent. Each ramus bears six setæ ; of these, five are subequal in length and breadth, and arise from the margin of the ramus, and the 6th arises from the dorsal aspect between the 1st and 2nd setæ, exactly as figured by Bourne (1890, pl. xxxvii, fig. 7). The outermost seta arises from the external margin near the proximal end.

The 1st antenna (Text-fig. 37, C) is composed of five segments that have the following proportional lengths :

Segment 1.	2.	3.	4.	5.
17	17	14	27	25 = 100

The 1st segment bears a short seta distally on its anterior margin. The 2nd segment bears three short setæ on the anterior margin and one long one on the outer aspect : Bourne (*loc. cit.* pl. xvii, fig. 7) figures only two short setæ on this segment. The 3rd segment is short and bears one long and one short setæ on the anterior margin, and another long one on the outer aspect. The 4th segment is slightly swollen in the proximal half, and this portion of the segment bears four short setæ on the anterior margin, and a single long seta arises from the outer aspect ; the distal portion of the segment appears to have



TEXT-FIG. 37.—*Monstrilla anglica* Lubbock, ♂. A, Abdomen, lateral view. B, Abdomen, ventral view. C, 1st antenna.

a low crest along the anterior border. The joint between the 4th and 5th segments is hinged. The terminal segment is somewhat spindle-shaped, and terminates in a short straight spine ; a group of three short setæ arise from the anterior margin near the distal end, and four long setæ arise from the outer aspect. Of these four setæ, two, according to Bourne (*loc. cit.*), are dichotomously branched, but no such branching was observed in any of the setæ in the present specimen.

REMARKS.—There can, I think, be little doubt that this example is a specimen of *Monstrilla anglica* Lubbock and, with the exception of the absence of the dichotomously branching setæ of the 1st antenna, it agrees with the description and figures given by Bourne. T. Scott (1900, p. 398, pl. xiii, figs. 16, 19 and 20) under the name *Monstrilla* (?) *Danæ*, described a male that agrees closely with the above, and in a subsequent paper (1904, p. 246, pl. xiii, fig. 13, pl. xiv, figs. 12–14) he described a female that appeared to agree with the above male and referred both to *Monstrilla anglica* Lubbock. In both sexes, however, Scott's specimens showed a difference from the true *M. anglica* Lubbock, in that the 4th furcal seta is very much smaller and more delicate than the others that

spring from the outer and distal margins, in this respect agreeing with the form described by Giesbrecht from the Antarctic under the name *Monstrilla conjunctiva* and that recorded by Sars from the coast of Norway as *M. leucopis*.

Wilson (1932, p. 394) has given what purports to be a description of both male and female *M. anglica* Lubb. Unfortunately, the only references to the literature that he gives are to the papers by Lubbock and Bourne ; both these authors described the male, but neither of them had seen a female of the species, and Wilson's own observations are limited to two males. Judging from the account that he gives it seems probable that the account of the female was taken from the paper by T. Scott (1904), of what he at first regarded as *M.* (?) *danæ* and later referred to *M. anglica :* but, as mentioned above, these specimens are almost certainly a different species, closely related to *M. conjunctiva* Giesbrecht and *M. leucopis* Sars. The true female of *M. anglica* Lubbock appears still to be unknown.

Distribution.—Nicobar Islands, Indian Ocean (present record), and the English Channel (Lubbock and Bourne).

Monstrilla (?) *conjunctiva* Giesbrecht. (Text-fig. 38, A–E.)

Monstrilla conjunctiva, Giesbrecht, 1902, p. 40, pl. xii, figs. 1–6.

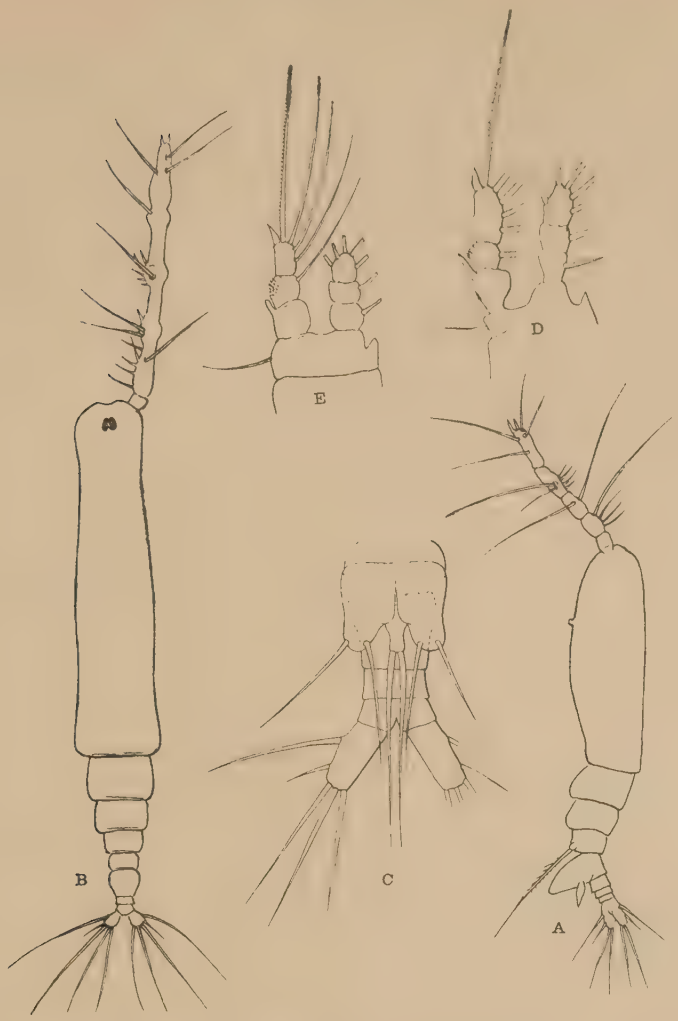
Occurrence.—Nankauri Harbour, Nicobar Islands ; in surface tow-net. One male and one female.

Descriptive Notes.—♂. Total length 1·55 mm.

This agrees closely with Giesbrecht's example, which measured 1·5 mm. The proportional lengths of the various segments of the body are as follows :

Cephalon-Th. 1.	2.	3.	4.	5.	Abd. 1–2.	3.	4.	5.	Furca.
513	123	88	70	40	35	26	22	13	70 = 1000

Giesbrecht does not give any measurements of the lengths of the segments in his specimen but so far as one can judge from his figure, they would appear to be very similar to the above. The head and 1st thoracic segment (Text-fig. 38, A) are fused, and the mouth-opening divides this region into two parts, the anterior or pre-oral and posterior or post-oral, which have the proportions of 1 to 1·6. Giesbrecht gives the proportions in *M. conjunctiva* as 1 to 1·5 ; in *M. leucopsis* Sars (1921, p. 15, pl. vii) it would seem, judging from the figure, to be about 1· to 1·4. The abdomen is composed of four segments. The genital segment bears ventrally a sac-like protuberance that terminates on each side in a conical projection, that appears to be rather more pointed than in Giesbrecht's example, and more closely resembles that of *M. leucopsis* Sars. On the postero-lateral border of this sac, about half-way along its length is a spine-like process that is thick at the base and tapers to the free end and is serrated along its outer margin. The furcal rami appear to be nearly equal in length to the last three abdominal segments ; each bears four setæ, of which the outermost is long and arises from the outer margin, not far from the proximal end, then comes a short seta that springs from the ramus at about the junction of the middle and distal thirds of its length, and, finally, two long setæ spring from the distal extremity. The long setæ are about equal in length to the abdomen. The arrangement of these setæ agrees exactly with *M. conjunctiva* Giesbr.



TEXT-FIG. 38.—*Monstrilla* (?) *conjunctiva* Giesbrecht. A, Lateral aspect, ♂. B, Dorsal aspect, ♀. C, Ventral aspect of 5th thoracic segment and abdomen, ♀. D, 2nd swimming leg, ♀. E, 1st swimming leg, ♂.

The 1st antenna is composed of five segments, the 2nd and 3rd appearing to be partially fused together. The proportional lengths of these segments are as follows :

Segment 1.	2.	3.	4.	5.
15	16	21	25	23 = 100

The 1st segment appears to be devoid of any setæ. The 2nd bears 3 or more short setæ and a single long one. The 3rd segment carries 2 long setæ. The 4th has a row of short, spine-like setæ on the proximal half of its length and two unequal seta are situated on the outer surface about the middle of its length. The 5th or distal segment bears one long seta about the middle of its length, one long and two shorter setæ near the distal end, and, finally, at the extreme apex carries two spine-like short setæ.

The 1st–4th swimming legs have a wide basal portion and the two rami are composed of three segments. In the 1st leg (Text-fig. 38, E) the 2nd basal segment is produced on its inner margin in a short spinous projection ; Giesbrecht (*vide* 1902, pl. xii, fig. 6) shows a small prominence on the inner margin, but not a definite projection. There is a seta on the outer margin. The 1st segment of the exopod is devoid of an inner seta, and the 2nd segment has no marginal spine, but is armed on its outer border with a group of small spinules. The 3rd segment of the exopod bears only 3 inner setæ, and the terminal spine is very long, about one and a half times the length of the whole exopod. In all the swimming legs, the external portion of the 2nd segment of the exopod is furnished with a number of small spinules.

The 5th leg is represented by a long seta that arises from the posterior border of the segment and reaches to the end of the furcal rami.

Giesbrecht described *Monstrilla conjunctiva* from the male only. A single specimen of an unknown female was taken by the "Investigator" in the same locality as the above male.

♀. Total length 3·85 mm.

The proportional lengths of the various segments of the body are as follows :

Cephalon-Th. 1.	2.	3.	4.	5.	Abd. 1–3.	4.	5.	Furca.
653	82	65	49	37	43	17	11	43 = 1000

The head and 1st thoracic segment (Text-fig. 38, B) are fused, and the abdomen is composed of three segments and the furcal rami : these last are about four times the length of the anal segment. The spinous processes arising from the ventral aspect of the genital segment are comparatively short and reach only a short distance beyond the tips of the furcal rami. Each furcal ramus bears five setæ of which three arise from the distal end of the ramus and are long, the 4th is short and delicate, and springs from the outer margin near the distal end, and the 5th is long and arises near the proximal end of the outer margin.

As Giesbrecht (*loc. cit.*) pointed out, the only other form then known, besides *M. conjunctiva*, in which this characteristic arrangement of the furcal setæ had been found is in the form described by T. Scott from the Firth of Forth first under the name *Monstrilla* (?) *Dancæ* Claparède (*vide* T. Scott, 1900, p. 398, pl. xiii, figs. 15–19) and later as *M. anglica* Lubbock (*vide* T. Scott, 1904, p. 246, pl. xiv, figs. 12, 14). Since then Sars (1921, p. 15, pl. vii) has recorded the same arrangement in *M. leucopis* from the coast of Norway.

The 1st antenna is rather more than one-third the length of the whole body ; only the proximal segment is distinctly separated off, the more distal segments being ill-defined. The distal end bears two spine-like short setæ, as in *M. conjunctiva* ♂.

The swimming legs (Text-fig. 38, D) closely resemble those of the above male. The 2nd basal segment has a small spinous projection on its inner border and bears an external seta. The 1st segment of the exopod is devoid of a seta on its inner margin, and the 2nd segment bears no marginal spine, but is armed on its outer aspect with a group of small spinules. Exopod 3 bears a single external marginal spine, and an end-spine that exceeds in length the whole ramus.

The 5th leg consists of a flat plate that at the base is about three-fifths as wide as long, but about two-thirds of the way along its length, the width abruptly decreases, and this narrow end portion bears two setæ on its distal margin. There is an extremely close

resemblance in this appendage to that of T. Scott's specimen (*vide* T. Scott, 1900, pl. xiii, fig. 18) and *M. leucopis* Sars (1921, pl. vii, p. 5).

Remarks.—There can be little doubt that a very close relationship exists between the present female example, the female that T. Scott (1900, 1904) recorded, as noted above, from the Scottish coast, and *M. leucopis* Sars (1921). Sars himself remarks "I have been in some doubt, if not the above-described form should be the same as that recorded by Scott under the name *M. anglica* Lubbock. Indeed in the structure of the last pair of legs and the peculiar reduction of the outermost but one of the caudal setæ, both these forms seem to agree pretty well." Other points in which these three forms agree closely are (1) the length of the 1st antenna, as compared with the length of the fused Cephalon-Th. 1,

in *M. leucopis* (from Sar's figure)	as 40 to 60
in T. Scott's example (from his figure) ..	as 42 to 58
in the present example	as 41 to 59

and the partial or nearly complete fusion of its distal segments with two small spine-like setæ at the extreme distal end; and (2) the moderate length of the egg-bearing setæ, which extend to about three-quarters the length of the furcal setæ.

Sars states that the general shape of the body in Scott's specimen is, judging from his figure, rather unlike his examples of *M. leucopis*, but Scott has given two different figures of his specimens, and while the later figure (*vide* T. Scott 1904, pl. xiii, fig. 13) is unlike, the earlier one (T. Scott, 1900, pl. xiii, fig. 15) is by no means so dissimilar, and is indeed not unlike the present specimen. The only other point of difference mentioned by Sars is that T. Scott states that there are 6 furcal setæ, whereas in *M. leucopis* there are only 5. Here again Scott's later figure differs from the earlier one (*cf.* T. Scott, 1900, pl. xiii, fig. 15 and 1904, pl. xiii, fig. 13) in that he shows a small dorsal accessory seta in addition to the other five, while this is not shown in the earlier figure. I am inclined to believe that T. Scott's examples and Sars' specimens are conspecific, and it is by no means improbable that these are equally conspecific with Giesbrecht's species *M. conjunctiva* from the Antarctic; if this should prove to be the case Giesbrecht's name will have priority.*

Distribution.—The Antarctic Ocean (Giesbrecht) and the Nicobar Islands, Indian Ocean (present record). If *M. leucopis* should prove to be conspecific, then the species occurs in the North Atlantic round the coasts of Scotland and Norway.

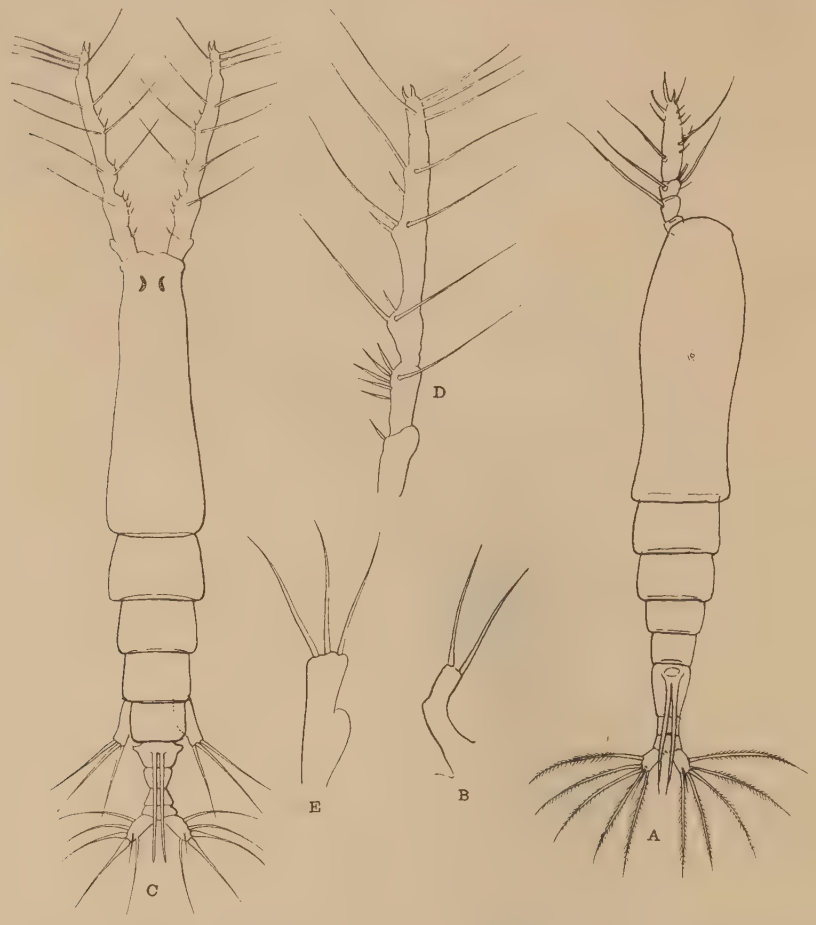
Monstrilla helgolandica Claus. (Text-fig. 39, A, B.)

Monstrilla helgolandica, Claus, 1863, p. 165, pl. xii, fig. 15, and pl. xiii, fig. 9; Timm, 1896, p. 376, pl. v, figs. 1 and 8, and pl. vi, figs. 2, 4, 6 and 8; van Breemen, 1908, p. 207, fig. 218; A. Scott, 1909, p. 238, pl. lviii, figs. 1 and 2; Sars, 1921, p. 18, pl. ix.
Monstrilla serricornis, Sars, 1921, p. 19, pl. x, fig. 1 (♂).

Occurrence.—Nankauri Harbour, Nicobar Islands; in surface tow-net. One female.

* T. Scott (1914, p. 375, pl. xvi, figs. 8–12) has described a female *Monstrilla* under the name *M. mixta*, from the Falkland Islands, and he states, "In its general appearance and structure this form is somewhat similar to *Monstrilla conjunctiva* Giesbr.," but in spite of the resemblance he concludes, "I am unable from the differences observed, to regard them as the male and female of the same species." *M. mixta* differs considerably from the above female both as regards the antennule, the 5th pair of legs, and the number and arrangement of the furcal setæ.

Distribution.—This species has now been recorded from the Malay Archipelago (A. Scott), the Nicobar Islands, Indian Ocean (present record), the English Channel (v. Breemen), the North Sea (Claus), the Skajerak (Timm), the coast of Norway (Sars) and the Gulf of Maine (Wilson, as *M. serricornis*).



Text-fig. 39.—*Monstrilla helgolandica* Claus, ♀. A, Dorsal aspect. B, 5th leg. *Monstrilla investigatoris* sp. nov., ♀. C, Dorsal aspect. D, 1st antenna. E, 5th leg.

Monstrilla investigatoris sp. nov. (Text-fig. 39, C, D and E.)

Occurrence.—Nankauri Harbour, Nicobar Islands; in surface tow-net. One female.

Descriptive Notes.—♀. Total length 2·65 mm.

The proportional lengths of the anterior and posterior regions of the body (Text-fig. 39, C) are as 83 to 17. The proportional lengths of the various segments of the body are as follows:

Cephalon-Th. 1.	2.	3.	4.	5.	Abd. 1–2.	3.	4.	5.	Furca.
493	104	93	88	52	41	36	26	15	52 = 1000

The head and 1st thoracic segment are fused, and the combined mass attains its widest diameter about one-fifth of its length from the posterior margin. The anterior border of

the head is emarginate in the middle line and the antero-lateral angles are produced and rounded. A pair of well-developed eyes are visible dorsally. The thoracic segments steadily decrease in size from before backwards. The abdomen is composed of three free segments, but there is an incomplete suture that runs across the genital segment similar to that found in *Monstrilla longicornis* Thompson, *M. longiremis* Giesbrecht, and *M. clavata* Sars. The anterior part of the genital segment is produced on each side in a short, rounded prominence : ventrally, it bears a pair of egg-setæ, but these were unfortunately broken. The posterior part of the genital segment and the 2nd free segment together present an hour-glass appearance owing to the constriction of their contiguous ends. The furcal rami are divergent, and each bears five well-developed setæ on the outer and distal margins and a small accessory seta on the dorsal aspect, six in all : thus this species resembles *Monstrilla grandis* Giesbrecht, *M. helgolandica* Claus, *M. gracillicauda* Giesbrecht and *M. anglica* Lubbock. The marginal setæ are sub-equal, and the basal ends of the 2nd and 3rd setæ are swollen, as Bourne (1890, pl. xxxvii, fig. 7) has shown to be the case with certain setæ in *M. anglica* Lubbock and Giesbrecht (1892, pl. xlvi, fig. 17) in *M. grandis* Giesbr.

The 1st antenna is about three-quarters the length of the fused cephalon and 1st thoracic segment ; only the proximal segment is clearly demarcated, the remainder forming a fused mass. The extreme distal end bears two short spine-like setæ.

The swimming legs are of the usual type.

The 5th leg (Text-fig. 39, D) is produced on its inner margin in a small but distinct inner lobe that bears no seta, and three sub-equal setæ spring from the rounded distal margin.

Remarks.—Sars (1921, p. 10) in his definition of the genus states as follows : " Caudal rami sublamellar, each provided in female with 5 or 6 setæ, one of which is generally shorter than the others and attached more dorsally ; those in male of same appearance as in female, but lacking one of the setæ." This, however, is not always true, for in certain species such as *Monstrilla grandis* Giesbrecht, there are six setæ in both sexes. Thus the male that corresponds to the present female might have either five or six setæ on each furcal ramus. I have above recorded the presence of what I take to be the male *M. anglica* Lubbock from the same locality as that in which the present female was taken, and it is possible that this is the hitherto unknown female ; as, however, it is impossible to determine this point until more material has been collected and examined, I have given the example a different specific name.

Distribution.—At present known only from the Nicobar Islands.

Monstrilla longipes A. Scott.

Monstrilla longipes, A. Scott, 1909, p. 238, pl. lviii, figs. 3, 4.

Occurrence.—Nankauri Harbour, Nicobar Islands ; surface tow-net. A single female.

Descriptive Notes.—♀. Total length, 2·25 mm.

This specimen was somewhat larger than Scott's type from the Malay Archipelago, which measured only 1·85 mm.

The proportional lengths of the various segments of the body are as follows :

Cephalon-Th. 1.	2.	3.	4.	5.	Abd. 1-3.	4.	5.	Furca.
581	91	79	67	49	61	24	12	36 = 1000

The genital segment, as Scott has noted, is divided into two sub-equal lengths by a groove or joint.

Distribution.—Up to the present time, this species has been recorded only from the Malay Archipelago (A. Scott) and the Nicobar Islands (present record).

Genus *Cymbasoma* Thompson.

Thaumaleus, Giesbrecht, 1892, p. 578 (not Kröyer).
Cymbasoma, Thomson, 1888, p. 145, 1890, p. 115; Sars, 1921, p. 19.

Up to the present time five species belonging to this genus have been recorded from the Indo-Pacific region. Wolfenden (1906, p. 1025, pl. xcix, figs. 31–33) recorded what he believed to be a new species, *Cymbasoma tropicus*, from the Maldive Archipelago. A. Scott (1909, p. 239 *et seq.*) described two more new species, *Cymbasoma bullatus* and *C. gigas*, from the region of the Malay Archipelago; and Gurney (1927, p. 169) recorded *Cymbasoma longispinosum* Bourne from the Suez Canal and described a new species *C. gracile*, from the same region. Of these Wolfenden claims that his species differs from *Cymbasoma longispinosum* (Bourne), *C. claparèdii* (Giesbrecht), which Sars regards as a synonym of *C. rigidum* Thompson, *C. reticulatus* Giesbrecht and *C. thompsoni* (Giesbrecht). A comparison of Wolfenden's description and figures with those given by Giesbrecht of the last-mentioned species reveals a very considerable degree of resemblance, and I am inclined to believe that Wolfenden's specimen is a representative of the species *C. thompsoni* Giesbrecht. Sars (1921, p. 25) created a new genus *Monstrillopsis* to accommodate *M. dubia* (T. Scott), and a comparison of his description and figures (*vide* Sars 1921, p. 26, pl. xiv) with those given by Gurney for *Cymbasoma gracile* (*vide* Gurney, 1927, p. 167, fig. 28) reveals such a degree of similarity that I am of the opinion that, if we accept Sars' new genus, then *Cymbasoma gracile* Gurney must be transferred to it. Among the present collections was a single example of a male, that does not appear to correspond with any known species.

Cymbasoma nicobarica sp. nov. (Text-fig. 40, A–D).

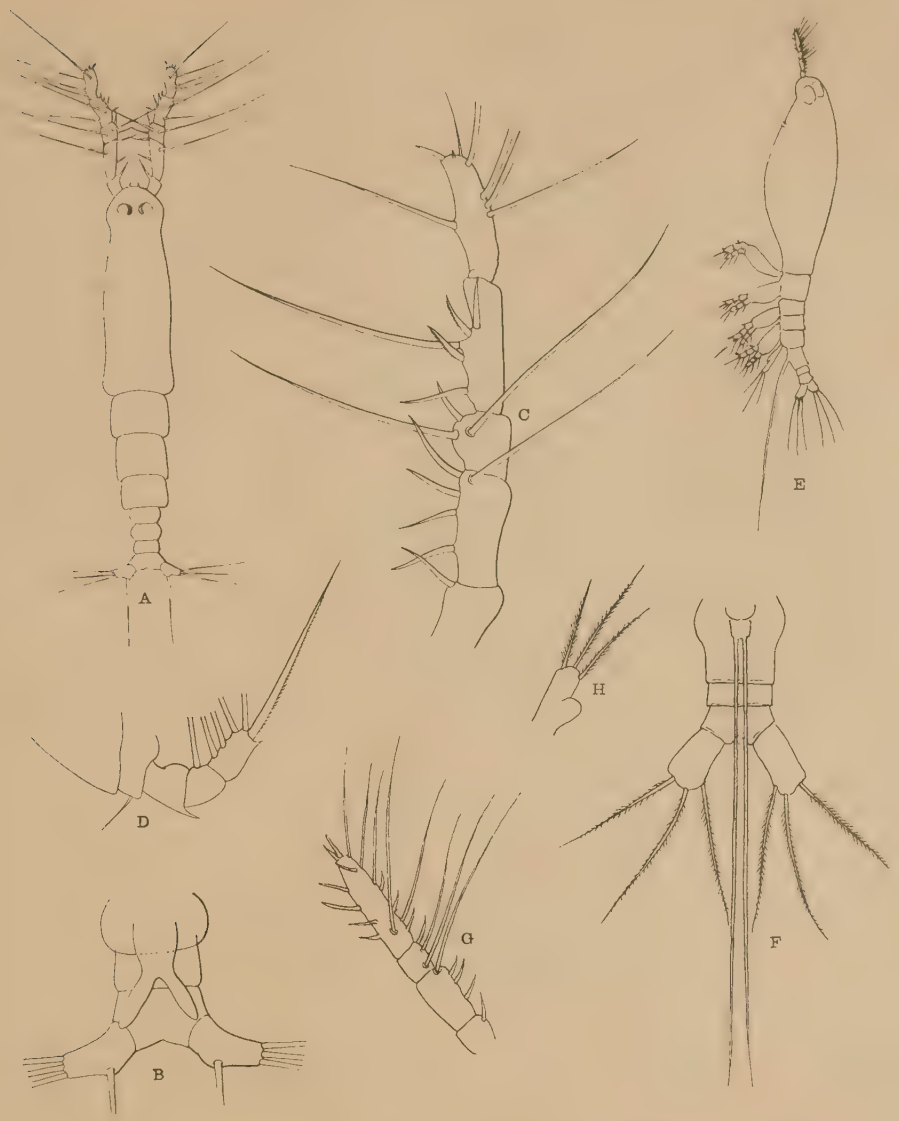
Occurrence.—Nankauri Harbour, Nicobar Islands; in surface tow-net. One male.

Descriptive Notes.—♂. Total length 1·5 mm.

The head and 1st thoracic segment are fused. The proportional lengths of the various segments of the body (Text-fig. 40, K) are as follows:

Cephalon-Th. 1.	2.	3.	4.	5.	Abd. 1-3.	4.	5.	Furca.
473	107	107	89	45	45	27	45	62 = 1000

The anterior border of the head is rounded, and a pair of minute hairs or projections spring from the surface between the origins of the 1st antenna, as Giesbrecht (1892, pl. xlvi, fig. 21) has figured in the case of *Cymbasoma rigidum* Thompson (= *Thaumaleus claparèdii* Giesbrecht). A pair of well-developed and deeply pigmented eyes are present, and behind these the lateral margin is somewhat constricted, thus forming a slight neck. The genital segment (Text-fig. 40, B) is oval in shape, and is considerably wider than long; from the ventral aspect arises a median genital appendage that bifurcates into two more or less



TEXT-FIG. 40.—*Cymbasoma nicobarica* sp. nov., ♂. A, Dorsal aspect. B, Ventral aspect of abdomen. C, 1st antenna. D, Exopod of 4th swimming leg. *Haemocera danae* (Clpd.) Malaquin, ♀. E, Lateral aspect. F, Ventral aspect of abdomen. G, 1st antenna. H, 5th leg.

cylindrical processes that extend backwards and outwards as far as the articulation of the furcal rami with the anal segment. Between the genital and anal segments is a single segment that is broader than long. The furcal rami are widely divergent and each bears four setæ, of which three arise from the distal end and spread out laterally, while the fourth arises from a low rounded swelling on the posterior and inner margin, and is directed backwards, thus resembling the condition present in the male of *Monstrillopsis dubia* (T. Scott).

The 1st antennæ (Text-fig. 40, C) are about one-third of the body-length, and are composed of five segments, the line of separation of the 2nd and 3rd segments, however,

being apparently incomplete. The proportional lengths of the various segments are as follows :

Segment 1.	2.	3.	4.	5.
15	22	12	26	25 = 100

The 1st segment bears a single spine-like seta ; the 2nd bears a row of four similar setæ on the inner margin, and a single long seta arises from the distal inner angle, the 3rd segment is short and bears two long setæ and a single, short, spine-like one ; the 4th segment bears a row of short spine-like setæ on the proximal two-thirds of its inner margin, and of these the 2nd and 3rd are serrated while the 4th is directed parallel to the main axis of the appendage ; it also bears a single long seta on its inner border a little beyond the middle of its length. There is a distinct hinge-joint between the 4th and 5th segments. The terminal segment bears at about the middle of its length one long seta on the inner margin, and a group of three on the outer margin ; another long seta arises near the distal end, and from the extreme distal margin arise a short spine and a single delicate seta, between which there is a very short spine-like projection.

The swimming legs have the usual form. I could detect no trace of a 5th leg.

Remarks.—It is possible that this is the unknown male of Wolfenden's species, *Cymbasoma tropicus*, but as it is impossible to reach any conclusion on this point, I have named the above specimen, *Cymbasoma nicobarica* sp. nov.

Distribution.—At present this species is known only from a single specimen taken in Nankauri Harbour, Nicobar Islands.

Genus *Hæmocera* Malaquin.

Hæmocera, Malaquin, 1901, p. 108 ; van Breemen, 1908, p. 202.

Hæmocera danæ (Clpd.) Malaquin. (Fig. 40, e—h.)

Hæmocera danæ. Malaquin, 1901, p. 88, fig. 2, pl. ii, figs. 1-5 ; van Breemen, 1908, p. 217, fig. 231.

Occurrence.—Nankauri Harbour, Nicobar Islands ; in surface tow-net. Two females.

Descriptive Notes.—♀. Total length 1·15 mm.

The head and 1st thoracic segment are fused together. The mouth is situated far forward near the anterior end, the pre-oral and post-oral parts of the cephalon being in the proportion of 12 to 43. Viewed from above, a pair of well-developed eyes, with hemispherical lenses and brown pigment, occupies a great part of the anterior region of the head in front of the mouth. The proportional lengths of the various segments of the body are as follows :

Cephalon-Th. 1.	2.	3.	4.	5.	Abd. 1-3.	4.	5.	Furca.
562	90	82	86	56	60	15	15	34 = 1000

The greatest diameter of the cephalo-thoracic region is situated a little in front of the middle of the segment. The genital segment (Text-fig. 40, f) is twice the length of the two following segments together. From the ventral aspect of the segment spring the

two egg-setæ, which extend backwards beyond the tips of the furcal setæ by a distance equal to the length of the furcal setæ themselves. The furcal rami are divergent and are slightly longer than the two preceeding segments together; each ramus bears three setæ of approximately equal length.

The 1st antennæ (Text-fig. 40, G) are about equal in length to the pre-oral region of the cephalon. They are composed of four segments that have the following lengths:

Segment 1.	2.	3.	4.
12	28	14	46 = 100

The swimming legs are of the usual pattern.

The 5th legs (Text-fig. 40, H) have a rounded projection on the inner border about half-way along their length; no seta arises from this inner projection. The distal end carries three setæ of about equal length. Malaquin does not give a separate figure of this appendage, but so far as one can judge from the figure of the hind region of the body (Malaquin, 1901, p. 109, fig. 2) it agrees exactly with the above; he states (*loc. cit.*, p. 94), "la partie basilaire non segmentée comprend un exopodite formé d'une seule pièce et supportant 3 soies, et un endopodite réduit à un moignon sans aucune production sétigère."

Remarks.—Although this species has not hitherto been recorded outside European waters, the two examples obtained in Nankauri Harbour agree so closely with the descriptions and figures given by Malaquin that I have no hesitation in ascribing them to his species. Sars (1921, p. 21) gives this species as a synonym of *Cymbasoma rigidum* Thompson. I can find no argument in favour of such a view. *Cymbasoma rigidum* differs from the above in (1) having only one segment between the genital and anal segments of the abdomen, instead of two, (2) in having an additional small seta, making four in all, on each furcal ramus, (3) in having on the 5th leg an inner lappet that extends as far as the tip of the outer branch, and (4) in having on this outer branch two long and one much shorter seta, instead of three setæ of nearly equal length.

Distribution.—Nankauri Harbour, Nicobar Islands (present record) and the English Channel.

NOTODELPHYOIDEA.

Family Botryllophilidæ.

Genus *Botryllophilus* Hesse.

Botryllophilus, Canu, 1892, p. 203; Sars, 1921, p. 67.

Examples of this genus are very rarely obtained. The first species to be described were *Botryllophilus ruber* Hesse (1864) and *B. virescens* Hesse; Della Valle (1883), under the name *Kossmechthrus notopus*, described another species from the Gulf of Naples; Canu (1892) described *B. macropus*; T. Scott (1900 and 1901) recorded the occurrence of examples of this genus under the name *Botryllophillus* (?) *ruber* Hesse, though he remarks, "It is probable that the species described above may be new to science, as it does not agree very satisfactorily with any described species known to me"; and Sars (1921) has described yet another species, *B. brevipes*. Sars is inclined to believe that the three forms known previous to his account of his examples of the genus, namely, *ruber* Hesse, *macropus*

Canu and those recorded by T. Scott as *ruber* Hesse, should be regarded as three distinct species, T. Scott's examples not being identical with *B. ruber*. If this be admitted, then each observer has had a different species to deal with, and the present specimen appears to be no exception to this rule. As in every previous instance the examples have been obtained in northern latitudes, Hesse's and Canu's from the English Channel, T. Scott's from the coast of Scotland, Della Valle's from the Mediterranean, and Sars' from the Norwegian coast, and the Woods Hole region of the east coast of North America (Wilson), the occurrence of a further example from the Indian Ocean is not without interest.

Botryllophillus indicus sp. nov. (Text-fig. 41, A–G.)

Occurrence.—Nankauri Harbour, Nicobar Islands ; in weed-washings. One female.

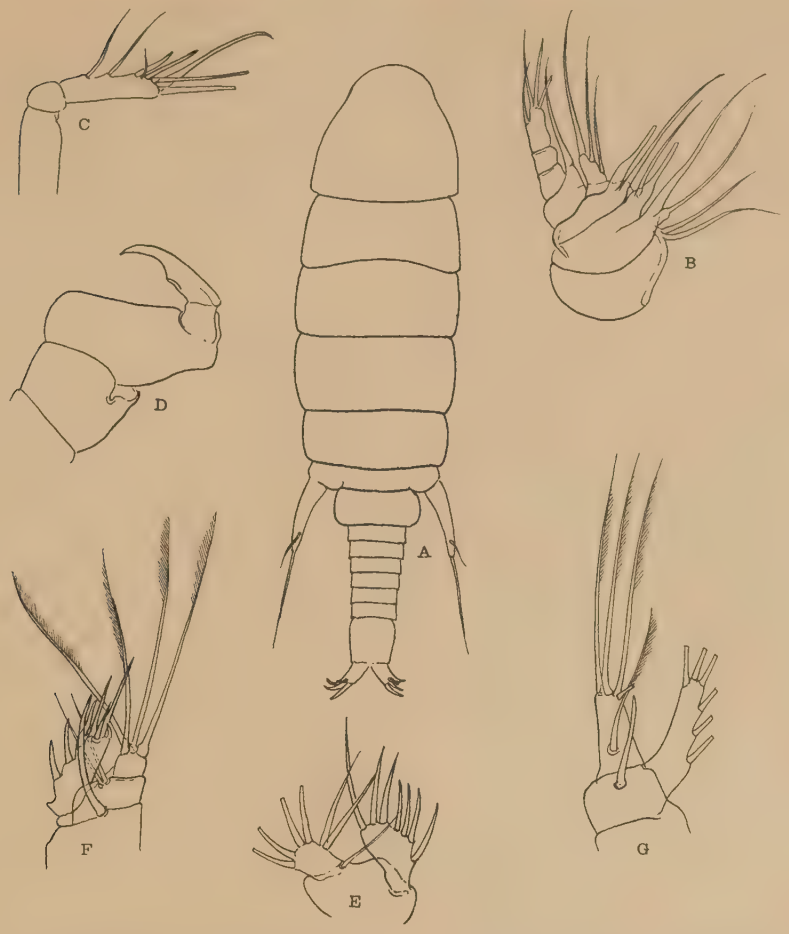
Descriptive Notes.—♀. Total length 1·5 mm.

The body (Text-fig. 41, A) is very sharply divided into anterior and posterior regions, which have the proportional lengths of 63 to 37. The cephalothorax is an oblong oval in shape. The cephalon is separate from the 1st thoracic segment, and all five thoracic segments are separate and clearly defined. Below the cephalic segment was what appeared to be a deflexed plate with a broadly rounded edge and a curved row of spines on each side ; this I take to be the rostrum. The 5th thoracic segment is about half the length of the 4th and at the postero-lateral angles the modified 5th pair of legs project backwards, reaching as far as the level of the posterior border of the 3rd abdominal annulus. Each bears at its apex a long terminal spine, that extends as far as the posterior border of the anal segment, and a much smaller and more delicate seta. The abdomen is composed of eight annuli, of which the first is about twice as long and much broader than those that immediately follow it ; probably this is the genital segment. Then follow six short annuli and finally there is a long anal segment. It seems probable that the six intermediate annuli represent 3 segments, that are subdivided. The proportional lengths of the various annuli of the abdomen and the furcal rami are as follows : 20, 8, 8, 8, 8, 8, 8, 20, 12. The furcal rami are divergent, and are armed at the distal end with four unequal curved claw-like spines, three arising from the distal margin and the much smaller 4th from the dorsal aspect near-by.

The 1st antenna (Text-fig. 41, B) is composed of two distinct parts, a very stout basal portion, and a narrower terminal portion. The basal part appears to be composed of 4, or possibly 5, segments. The 1st segment bears 2 setæ ; the 2nd, which appears to be partially subdivided, carries 4, arranged in two groups of 2 setæ each ; the 3rd segment has a proximal group of 2 and a distal group of 3 setæ, that arise from a projection on the anterior margin ; the 4th segment bears a single seta. The distal portion is composed of 3 segments. The terminal segment bears one seta on its posterior border and three distally. In the present example this appendage appears to differ from all others in having the stout basal portion divided into segments.

The 2nd antenna (Text-fig. 41, C) resembles that of other members of the genus and is composed of three segments, of which the 2nd is very short, and the 3rd has in all 8 spines and setæ, of which two setæ arise from the anterior border, two short straight spines and a delicate seta from the angle, and three long and not very strong spines from the distal margin.

I was unable to examine the mandible and maxillæ.



TEXT-FIG. 41.—*Botryllophilus indicus* sp. nov., ♀. A, Dorsal aspect. B, 1st antenna. C, 2nd antenna. D, Maxilliped. E, 1st swimming leg. F, 2nd or 3rd swimming leg. G, 4th swimming leg.

The maxilliped (Text-fig. 41, D) forms a very powerful grasping organ. The 1st and 2nd segments are large and strong, and articulated at the distal end of the 2nd segment is a claw-like portion composed of a short segment that bears distally a stout curved claw.

The 4 pairs of swimming legs are much reduced, and in the main resemble those of *B. brevipes* Sars. In the 1st leg (Text-fig. 41, E) the 2nd basal segment bears a single delicate seta on its distal margin. The exopod is triangular in shape and is armed with 7 spines. Of these the 1st arises not far from the base of the segment on the outer margin, and opposite it on the inner border is a small notch, that suggests that originally there were two segments in the ramus. Then on the outer border follows a group of three sub-equal spines; two more spines, somewhat larger and sub-equal, arise from the distal border, and finally a single, considerably longer, spine arises from the distal inner angle. The endopod is shorter than the exopod and bears 6 setæ.

In the 2nd and 3rd legs (Text-fig. 41, F) the 1st basal segment bears a stout spine, and two more delicate setæ appear to arise from the 2nd basal segment near the distal margin between the two rami, but possibly this part represents the proximal segment of

the endopod, fused with Basal 2. The exopod appears to be composed of a single segment, which is armed with 7 spines and the distal inner angle is produced in a small outwardly curved tooth. The endopod is only about one-third the length of the exopod, and bears 4 long setæ, which are smooth proximally and plumose in the distal half or one-third.

In the 4th leg (Text-fig. 41, G) the exopod bears 6 spines, 3 on the outer margin, two distally, and one at the distal inner angle. The endopod bears one seta near the proximal end and 4 setæ distally. A spine-like seta arises from the 2nd basal segment near the distal border between the two rami.

GEOGRAPHICAL DISTRIBUTION.

Among the species under review in this Report we find very considerable differences in the life-history. As Sars (1913–18, p. 2) has pointed out, " the habits of the Cyclopoida are much more varied than is the case with the Calanoida and Harpacticoida. Some of them, for instance the species of the genus *Oithona*, are true pelagic animals, constituting a chief part of the plankton in almost all regions of the Oceans. Several other forms, like the Harpacticoida, live near the shores among algæ or on a muddy bottom at different depths, and a great number of forms lead a more or less pronounced parasitic existence attacking different invertebrate animals, in some instances also fishes. In most cases, however, the parasitism may be said to be merely temporary, though there are also a few examples of a more permanent parasitism, for instance in the case of *Ergasilus* and *Nicothoë*." In the group Gnathostoma the relationship that exists between the Copepod and its so-called " host " appears for the most part to be of the nature of symbiosis or commensalism rather than parasitism, and moreover is usually confined to the adult females, the adult males and the young of both sexes being free-swimming : even in the Siphonostoma, in which the mouth parts are modified to form an apparatus designed for piercing and sucking, " none of them are to be regarded as permanent parasites . . . though the structure of the mouth-parts evidently shows them to be adapted for temporary parasitic habits " (Sars, 1913–18, p. 83). It further appears probable that there is little or no " specific " relationship between the copepod and the animal it " parasitizes," and the majority of these Cyclopoids may be found associated with a series of hosts, though in a number of species these latter do appear to belong to a single Phylum or Order. Each Phylum may, however, serve as " host " to species belonging to a number of different genera. Monod and Dolfus (1932) have given a list of the Mollusca that have been found to harbour these " semiparasitic " forms and the species that have been recorded from each, and I give below a list of the Invertebrate Phyla and the various genera of Cyclopoida that have been found associated with them :

Phylum.		*Cyclopoid genus.*
Porifera	can be host to species of	*Asterocheres* (= *Ascomyzon*)
		Acontiophorus.
		Doropontius.
		Herrmannella.
		Hersiliodes.
		Lichomolgus.
		? *Solenodiscus.*

Phylum.		*Cyclopoid genus.*
Cœlenterata		
Alcyonaria	(ditto)	*Asterocheres* (= *Ascomyzon*).
		Lamippe.
Annelida		
Polychæta	,,	*Lichomolgus.*
		Eunicicola.
		Sabelliphilus.
Arthropoda	,,	*Clausidium.*
		Giardella.
		Hersiliodes.
		Nicothoë.
Mollusca		
Tectibranchiata	,,	*Anthessius* (= *Pseudomolgus*).
		Stellicola (= *Lichomolgus*).
Nudibranchiata	,,	*Anthessius* (= *Pseudomolgus*).
		Artotrogus.
		Lichomolgus.
		Macrochiron.
		Paralichomolgus.
Gasteropoda	,,	*Conchocheres* (= *Panaietis*).
		Lichomolgus.
Lamellibranchiata	,,	*Conchocheres* (= *Panaietis*).
		Herrmannella.
		Lepeopsyllus.
		Lichomolgus.
		Modiolicola.
		Myicola.
		Obesiella.
		Philoconcha.
		Pseudanthessius.
		Pseudolichomolgus.
		Pseudomyicola.
Cephalopoda	,,	*Cholidya.*
		Lichomolgus.
Echinodermata	,,	*Asterocheres* (= *Ascomyzon*).
		Cancerilla.
		Collocheres.
		Echinicola.
		Echinocheres.
		Parartotrogus.
		Pseudanthessius.
		Scottomyzon.
		? *Solenodiscus.*

Phylum.		*Cyclopoid genus.*
TUNICATA		
Ascidiacea	(ditto)	*Acontiophorus.*
		Artotrogus.
		Asterocheres (= *Ascomyzon*).
		Lichomolgus.
Thalliacea	,,	*Sapphirina.*

In a number of instances the specimens that have been captured have been sorted out from the mud in which the so-called "host" was embedded: Giesbrecht himself (1899) has pointed out that, though it appears to have been proved that *Ophioglypha lacertosa* is the "host" of *Parartotrogus richardi*, he personally has never found the parasite actually *in situ* on the Brittle-Star but invariably in the dredged material surrounding it.

It is equally clear that a number of genera have been found associated with "hosts" belonging to different Phyla or Orders; thus,

Lichomolgus occurs in association with		PORIFERA.
		ANNELIDA, Polychæta.
		MOLLUSCA, Nudibranchiata.
		Gasteropoda.
		Lamellibranchiata.
		Cephalopoda.
Asterocheres (= *Ascomyzon*)	(ditto)	PORIFERA.
		CŒLENTERATA, Alcyonacea.
		ECHINODERMATA.
		TUNICATA, Ascidiacea.
Acontiophorus	,,	PORIFERA.
		TUNICATA, Ascidiacea.
Herrmannella	,,	PORIFERA.
		MOLLUSCA, Lamellibranchiata.
Hersiliodes	,,	PORIFERA.
		ARTHROPODA.
Solenodiscus	,,	PORIFERA.
		ECHINODERMATA.
Artotrogus	,,	MOLLUSCA, Nudibranchiata.
		TUNICATA, Ascidiacea.
Pseudanthessius	,,	MOLLUSCA, Lamellibranchiata.
		ECHINODERMATA.
Anthessius (= *Pseudomolgus*)	,,	MOLLUSCA, Tectibranchiata.
		Nudibranchiata.

In many species in which, up to the present time, only a single host has been recorded, it seems probable that this is due merely to insufficient knowledge, the species having been recorded on only one or two occasions, and that further research will reveal the

existence of other " hosts." Such a well-known species as *Lichomolgus agilis* Leydig has been recorded from the following hosts :

Æolidia papillosa (Linn.).
Facelina longicornis (Montagu).
Facelina curta (Alder and Hancock).
Janolus hyalinus (Alder and Hancock).
J. crustatus (Delle Chiaje).
Proctonotus mucronifer Alder and Hancock.
Idula coronata (Gmelin).
Armina verrucosa (Cantraine).
Sphærostoma hombergi (Cuvier).
Staurodoris verrucosa (Cuvier).
Archidoris tuberculata (Cuvier).
A. britannica (Johnston) Bergh.
Thordisa millegrana (Alder and Hancock).
Jorunna tomentosa (Cuvier).
Glossodoris elegans (Cantraine).
Dendrodoris lugubris (Gravenhorst).
Euphurus claviger (O. F. Müller).
Palio lessoni (d'Orbigny).
Polycera sp.
Doris johnstoni Alder and Hancock.
Cardium edule Linn.

All these hosts belong to the Phylum Mollusca and the majority to the Nudibranchiata. A closely related species, *Lichomolgus albens* Thorell, has been recorded from

Ciona intestinalis Müller,
Ciona canina Müller,
Corella paralellogramma Alder,
Cynthia lurida Thorell,
Molgula socialis Alcock,
Perophora listeri M. Don,
Phallusia mentula Müller,
P. patula Alder,
P. virginea Müller,

all of which are Tunicata, Ascidiacea.

Among the Ergasilidæ that " parasitize " fish there appears to be in some species a similar wide choice of hosts ; T. Scott (1901, p. 121) gives the following hosts for the species, *Bomolochuss soleæ* Claus :

Cyclopterus lumpus L. (the Lumpsucker),
Gadus callarius L. (the Cod),
G. æglefinus L. (the Haddock),
G. merlangus L. (the Whiting),
G. pollachius L. (the Pollack),
Pleuronectes platessa L. (the Plaice),
P. flesus L. (the Flounder),
Solea vulgaris (the black sole),

and in a later report (1905, p. 108) he adds :

Gadus luscus L. (the Brassie),
G. morrhua L. (the Cod),
Molua molva L. (the Ling).

A number of species have been captured in the tow-net, while swimming freely or in association with floating weed-masses, while others seem, at least during some part of their existence, to frequent beds of weed.

Thorell (1860) has recorded that *Dyspontius striatus* Thorell was taken by Lillejeborg in the open sea ; Brady (1880) has recorded *Asterocheres boecki* Brady, *Acontiophorus scutatus* Brady, *Dermatomyzon nigripes* Brady and *Lichomolgus furcillatus* Thorell in tow nettings ; and in 1910 he records the occurrence of *Scottocheres elongatus* T. and A. Scott and *Cryptopontius innominatus* Brady in the tow-net. T. Scott (1894) recorded the presence of the following in tow-net gatherings at the surface in the Gulf of Guinea : *Hersiliodes livingstoni* T. Scott, *Lichomolgus congoensis* T. Scott and *Pseudanthessius proximus* T. Scott, while *Pontœciella abyssicola* (T. Scott) was obtained in tow-net gatherings from 235 and 360 fathoms depth. The same author (1912) recorded *Macrochiron fucicolum* Brady and *Pseudanthessius fucicolus* T. Scott associated with weed in surface tow-net gatherings from the tropical and northern regions of the North Atlantic Ocean, and Sars has recorded *Macrochiron sargassi* from the same region. A. Scott (1902) has recorded *Lichomolgus minor* A. Scott from the surface water of the Red Sea. Thompson and A. Scott (1903) obtained *Pseudanthessius maximus* Thompson and A. Scott from tow-nettings on the Ceylon Pearl Banks, and *Hersiliodes dubia* Thompson and A. Scott from the Suez Canal ; A. Scott (1909) has noted that in the " Siboga " collections from the Malay Archipelago *Herrmannella concinna* A. Scott, *Pseudanthessius obscurus* A. Scott, *P. parvus* A. Scott and *P. pectinatus* A. Scott were taken in the tow-net : Sars (1913–18) records having taken *Bradypontius magniceps* (Brady) and *B. papillatus* (T. Scott), as well as the males of *Cancerilla tubulata* Dalyel, in the open sea ; and among the present collections I have taken in the surface tow-net *Macrochiron* (*Paramacrochiron*) *maximum* (Thompson and A. Scott), *Kelleria andamanensis* sp. nov. and *K. gurneyi* sp. nov.

A number of species have also been taken among weeds. Brady (1880) has recorded *Asterocheres boecki* Brady, *Dyspontius striatus* Thorell, *Acontiophorus striatus* Brady and *Macrochiron fucicolum* Brady from such a habitat.

Sars (1913–18) has recorded the occurrence of the following species in weed on the coast of Norway :

Cyclopina littoralis Brady,
Euryte longicauda Philippi,
Ascomyzon latum Brady,
Acontiophorus scutatus Brady,
Dyspontius striatus Thorell,
Artotrogus orbicularis Boeck,
Macrochiron fucicolum Brady,

and Kunz (1935) has recorded *Bradypontius papillatus* (T. Scott), *Ascomyzon parvum* (Giesbrecht), *Dermatomyzon nigripes* (Brady) and *Scottocheres elongatus* (T. and A. Scott)

either free or in weed in Kiel Bay. In the present collections no less than 24 species of Cyclopoida have been taken in weed-washings, namely :

Pterinopsyllus egregius Giesbrecht,
Euryte robusta Giesbrecht,
E. brevicauda sp. nov.,
Eurycyclops magna sp. nov.,
E. parva sp. nov.,
Anthessius brevifurca sp. nov.,
A. investigatoris sp. nov.,
Hemicyclops indicus sp. nov.,
Lichomolgus rotundatus sp. nov.,
Macrochiron (*Macrochiron*) *hirsutipes* (T. Scott),
M. (*M.*) *longipes* sp. nov.,
M. (*M.*) *spinipes* sp. nov.,
M. (*Paramacrochiron*) *parvum* (A. Scott),
Kelleria camortensis sp. nov.,
Preherrmannella adduensis sp. nov.,
P. brevicauda sp. nov.,
P. nicobarica sp. nov.,
Pseudanthessius gracilioides sp. nov.,
P. obscurus A. Scott,
Dermatomyzon nigripes (Brady),
Asterocheres orientalis sp. nov.,
A. manaarensis Thompson and A. Scott,
Asteropontius nicobaricus sp. nov.,
Acontiophorus maldivensis sp. nov.,

and to these may be added *Botryllophilus indicus* sp. nov.

In the case of the Sapphirinidæ the females are not infrequently to be found in the branchial cavity of certain Salps, whereas the immature forms of both sexes and the adult males are free-swimming. The association between the Notodelphyoida and Monstrilloida and their hosts appears to be somewhat closer. The Notodelphyoida are for the most part found living within the branchial cavity of the host, but among the family Ascidicolidæ the habitat is the alimentary canal. In *Enterognathus comatulæ* Giesbrecht, which is parasitic on the Crinoid *Antedon rosacea*, the male is free-swimming but the female inhabits the alimentary canal : the earlier stages of both sexes enter the alimentary canal in the 2nd copepodid stage, and subsequent development is carried out in this habitat ; and it has been suggested that the adult female leaves the alimentary canal and is fertilized by the male while clinging to the outside of the host (*vide* Giesbrecht, 1900). In the same family the species *Zanclopus cephalodiscus* Calman, parasitic on *Cephalodiscus* on the South African coast, *Trochicola enterica* Dollfus, described from the English Channel and parasitic on the mollusca *Zizyphinus zizyphinus* L. and *Gibbula cineraria* Lamarck, and *Mytilicola intestinalis* Steuer, parasitic on *Mytilus galloprovincialis* in the Mediterranean Sea, inhabit the alimentary canal. In the Monstrilloida genuina the work of Malaquin has definitely proved the parasitic nature of the association ; but in this group it is the immature stages that are parasitic, the adults being free-swimming.

Bathymetric Range.

The bathymetric range of the semi-parasitic species of Cyclopoida and Notodelphyoida and of the parasitic Monstrilloida appears to be a relatively small one. Most of the examples of the species that have so far been captured have been taken in the shallow water of the littoral zone, and in the majority of instances in the upper 100 m. A few species have, however, been recorded from depths considerably greater than this. Brady (1910) has recorded the following from a depth of 350–385 m. in the Antarctic Ocean :

Cyclops glacialis Brady.
Euryte propinqua Brady (? = *E. robusta* Geisbrecht).
Lichomolgus tenuicornis Brady.
L. fuliginosus Brady.
Dermatomyzon giesbrechti Brady.
D. herdmani Brady.
D. imbricatum Brady.*
Collocheres dubia Brady.
Bradypontius ignotus Brady.
B. serrulatus Brady.
Dyspontius latus Brady.
Urogonia typica Brady.
Dystrogus uncinatus Brady.
Pteropontius scaber Brady.
Pteropontius sp.
Artotrogus gigas Brady.
A. sphæricus Brady.
Solenodiscus formosus Brady.
Notodelphys antarcticus Brady.

Sars (1917) has recorded the peculiar Cyclopoid, *Urocopia singularis* Sars, from a depth of 600–700 m. in the North Atlantic Ocean.

T. Scott (1894) has recorded *Pontæciella abyssicola* (T. Scott) from a depth of 658 m. in the Gulf of Guinea, and Farran (1926) has taken *Ratania atlantica* Farran between 1050 and 1829 m. in the Bay of Biscay. Hansen (1923) in the North Atlantic and Arctic region has recorded the following :

Bradypontius grœnlandicus Hansen *B. tenuipes* Hansen	from 582 m.
Metapontius latispinis Hansen	,, 862 m.
Bradypontius dentatus Hansen	,, 1039 m.
Ascomyzon intermedium Hansen *A. tenerum* Hansen	,, 1065 m.
Scottocheres gracilis Hansen	,, 1461 m.
Acontiophorus ornatus Brady and Robertson	,, 2192 m.
A. antennatus Hansen *Ascomyzon adyssi* Hansen	,, 2624 m.

* It seems probable that this species should be referred to the genus *Rhynchomyzon*.

A. Scott (1909) has recorded the following species from a depth of 1595 m. in the Malay Archipelago :

Lichomolgus anomalus A. Scott,
L. buddhensis Thompson and A. Scott,
L. elegans Thompson and A. Scott,
L. gigas Thompson and A. Scott,
Paralichomolgus curticaudatus Thompson and A. Scott,
Pseudanthessius weberi A. Scott,

and *Herrmannella concinna* A. Scott from a vertical tow-net from 2000–0 m.

It is of some interest to note that several of these deep-dwelling species are known to occur also in quite shallow depths : thus *Pontæciella abyssicola* was taken off the Australian Barrier Reef in a vertical haul from only 38 to 0 m. (Farran) : *Acontiophorus ornatus* (Brady and Robertson) has been taken on the Norwegian coast in about 55 m. (30 fms., Sars) : *Lichomolgus anomalus* A. Scott occurs in the present collection at a depth of 38 m. ; and *Lichomolgus buddhensis, L. elegans* and *L. gigas*, all of Thompson and A. Scott, were first recorded from the Ceylon Pearl Banks, over which the average depth of water is under 20 m., and the first of these also occurred in the Malay Archipelago at a depth of 32 m. In other instances, such as *Herrmannella concinna* A. Scott, the animal formed part of the Plankton and thus may have been captured at any depth during the hauling of the net between 2000 and 0 metres, and Hansen in his Report (1923, p. 3) remarks " It is of course impossible to decide whether the animals in question in every case lived at the bottom, or perhaps sometimes have been captured in the trawl (or dredge) while it was hauled upwards."

It thus appears possible that a depth of 2500–3000 m. represents the extreme limit to which these species have been able to penetrate.

Geographical Distribution.

In previous papers (Sewell, 1940*a* and 1948) I have reviewed the means of dispersal that appear to be effective in determining the distribution of the littoral and weed-haunting Harpacticids and of the planktonic Calanoida, Harpacticoida and Cyclopoida. In the case of the planktonic species there can be little doubt that the surface or deep currents are now and have been in past times to a large extent responsible for their distribution, though these currents have been influenced and modified by changes in the relative position of land and sea and by the opening or closing of certain passages from one ocean to another brought about by orographic changes. Regarding those species of the Harpacticoida that are more at home in crawling among the sand grains of the sea bottom than in swimming in open water, I suggested that active migration could only be carried out along the margins of the continents, and that we must look for some other means of dispersal across the wide spaces of the ocean basins. One such means of dispersal appears to be the agency of floating weed masses or weed-covered objects, such as ship's bottoms or floating logs ; and, in the case of the latter, distribution will follow the direction of flow of the surface currents.

During the free-swimming stage of their life history individuals must be influenced by the flow of the surface currents. Many of the " hosts " themselves possess a sessile habit, as for instance the Sponges, Alcyonacea, Serpulid worms and the sessile Ascidians,

all of which owe their distribution to the drifting of their planktonic larvæ : others, such as the Mollusca, with the exception of the Cephalopoda, the Crinoidea, Echinoidea and Asteroidea, possess a certain limited range of movement that in the course of years may carry them long distances, but their distribution too is to some, and possibly a large; extent dependent upon the dispersal of their planktonic larvæ (*vide* Sewell, 1940*b*). In the case of the truly parasitic Copepods their dispersal is restricted by the necessity of reaching a suitable host within the time-limit of a single generation, and this may hold good for the semi-parasitic forms also. It would thus appear to be justifiable to conclude that in the past, except for those species that can inhabit weed, dispersal has been carried out for the most part along the coastal shores of the continents, and that it has been difficult, if not impossible, for species to pass freely, as do many of the truly planktonic species, by means of ocean currents across the great ocean basins from shore to shore.

The confinement of these species to the relatively shallow water, less than some 2500–3000 m. depth, of the littoral region and the continental slopes would thus be a bar, even if suitable hosts were available, to their migration from one continent to another by way of the deep ocean bed. That such is actually the case appears to be indicated by a comparison of the faunas of the east coast of North America on the west and the coasts of Europe, Great Britain, the English Channel and of Norway on the east. Thanks to the work of Bassett-Smith (1899), Wilson (1906, 1913, 1932 *a* and *b*, and 1935) and Nicholls (1940), I have been able to collate references to 48 species of Cyclopoida, Notodelphyoida and Monstrilloida from the American coast and the West Indies, namely :

CYCLOPOIDA.

Cyclopinidæ.

Cyclopina agilis Wilson.
C. laurentica Nicholls.
C. vachoni Nicholls.

Cyclopidæ.

Halicyclops magniceps (Lilljeborg).
H. exiguus Kiefer.

Dyspontiidæ.

Cryptopontius gracilis Wilson.

Clausidiidæ.

Hemicyclops adherens (Williams).
Clausidium caudatum (Say.).
C. dissimile Wilson.

Lichomolgidæ.

Myicola major (Williams).
M. metisensis Wright.
Macrochiron fucicolum Brady.
Modiolicola jamaicensis Wilson.

ERGASILIDÆ.

Ergasilus centrarchidium Wright.
E. fundali Kröyer.
E. labracis Kröyer.
E. lizæ Kröyer.
E. longimanus Kröyer.
E. longipalpis Wilson.
E. mugilis Vogt.
E. myctorothes Wilson.
? *E. sieboldi* Nordman.

BOMOLOCHIDÆ.

Tucca impressus Kröyer.
T. corpulentus Wilson.
Bomolochus concinnus Wilson.
B. attenuatus Wilson.
B. eminens Wilson.
B. exilipes Wilson.
B. nitidus Wilson.
B. nothrus Wilson.
B. scutigerulus Wilson.
? *B. soleæ* Claus.
B. teres Wilson.
Artocolax palleucus Wilson.
A. sætiger Wilson.
A. ardeola (Kröyer).

TÆNIACANTHIDÆ.

Tæniacanthus albidus Wilson.

NOTODELPHYOIDA.

NOTODELPHYIDÆ.

Notodelphys agilis Thorell.

DOROPYGIDÆ.

Doropygus cæruleus Gray.
D. curvatus Gray.
D. laticornis Wilson.
D. pulex Thorell.

BOTRYLLOPHILIDÆ.

Blakeanus corniger Wilson.
Botryllophilus brevipes Sars.

MONSTRILLOIDA.

MONSTRILLIDÆ.

Monstrilla anglica Lubbock.
M. canadensis MacMurrich.
M. serricornis Sars (= *M. helgolandica* Claus).
Cymbasoma rigidum Thompson.

Of the above 48 species only 11, of which 3 are doubtful, have been recorded from both the west and east sides of the North Atlantic Ocean, namely :

? *Halicyclops magniceps* (Lilljeborg) [= *H. æquoreus* Fischer].
Macrochiron fucicolum Brady.
Ergasilus mugilis Vogt.
? *E. sieboldi* Nordman.
? *Bomolochus soleæ* Claus.
Notodelphys agilis Thorell.
Doropygus pulex Thorell.
Botryllophilus brevipes Sars.
Monstrilla anglica Lubbock.
M. helgolandica Claus (= *serricornis* Sars).
Cymbasoma rigidum Thompson.

Of these the occurrence on the west side of *Ergasilus sieboldi* Nordman and *Bomolochus soleæ* Claus appears to be open to doubt : *Halicyclops magniceps* (Lilljeborg) appears to have a world-wide distribution, but it is probable that a number of species have been recorded under this title : *Doropygus pulex* Thorell, *Monstrilla anglica* Lubbock and *M. helgolandica* Claus have been recorded from the Indian Ocean, and the last-named species from the West Pacific region ; they thus probably have a world-wide distribution ; *Macrochiron fucicolum* Brady is known to be an inhabitant of weed, and so can easily have been dispersed by means of the surface currents, as is the case with the epiplanktonic Calanoida and the weed-haunting Harpacticoida. If we exclude the three doubtful species, *Halicyclops magniceps*, *Ergasilus sieboldi* and *E. soleæ*, and two other widely distributed species, *Doropygus pulex* and *Monstrilla anglica*, both of which appear to have a more or less world-wide distribution and so may have reached both sides of the North Atlantic Ocean by more than one route, we are left with only six species or 8 per cent. of the American fauna that has succeeded in crossing the Atlantic Ocean from west to east. In striking contrast to this is the condition found in those semi-parasitic or parasitic species that inhabit fish. Wilson (1905) has recorded 72 species belonging to the Caligoida from the Wood's Hole region of the East coast of North America, and of these 28 have been recorded from the coasts of Europe and 2 others from West Africa, so that the percentage of occurrence on both sides of the Atlantic is here some 42 per cent. or more than five times as high. In certain of the genera the percentage is even higher than this : in the genus *Caligus* Wilson has recorded 18 species from the East coast of North America, namely :

? *Caligus aliuncus* Wilson.*

* No locality is given for this species, but it was captured by the U.S. Fishery Steamer "Albatross."

*C. *balistæ* Steenstrup and Lutken,
*C. *belones* Kröyer,
*C. *bonito* Wilson,
*C. *chelifer* Wilson,
C. *chimera* Wilson,
*C. *curtus* Müller,
C. *hæmulonis* Kröyer,
C. *isonyx* Steenstrup and Lutken,
C. *latifrons* Wilson,
C. *monacanthi* Kröyer,
C. *mutabilis* Wilson,
*C. *pelamydis* Kröyer (= *C. scomberi* Bassett-Smith),†
C. *productus* Dana,
*C. *rapax* M.-Edwards,
C. *rufimaculatus* Wilson,
C. *schistonyx* Wilson,
*C. *thymni* Dana (? = *C. coryphænæ* Steenstrup and Lutken),

and a nineteenth species, **Caligus centrodonti* Baird, has been recorded from the east coast of South America ; of these 19 species no less than 9, marked in the above list with an *, have been recorded from the east side of the Atlantic Ocean from either the British Isles, the Mediterranean Sea or the west coast of Africa. The percentage of occurrence on the two sides of the Atlantic Ocean in this genus is thus as high as 47. Similarly, in the genus *Pandarus*, Wilson has recorded five species from the east coast of America, namely :

**Pandarus bicolor* Leach,
**P. cranchii* Leach,
**P. satyrus* Dana,
P. *sinuatus* Say,
P. *smithi* Rathbun,

and of these, three, marked with an asterisk, have been recorded from the east side of the Atlantic Ocean, either round the coasts of Europe and in the Mediterranean Sea or on the African coast ; thus in this genus the percentage is 60. *Pandarus cranchi*, *P. satyrus* and *P. smithi* all have a very wide distribution and have been recorded from the Pacific Ocean. In these genera, that are parasitic on Fish, a high proportion of species have a wide distribution, but it seems probable that this is due to the migrations of the host, for these species become attached in the 1st copepodid stage, and although, when in the adult stage, they can leave the host, Wilson (1905, p. 483) gives it as his opinion that this very rarely occurs—" all the incentives are for remaining, rather than leaving the host and swimming about, and adult females almost always remain upon the fish."

So far as the geographical distribution of individual species is concerned, the number of observations that have been recorded is usually insufficient to enable one to form a complete picture. A systematic study of these groups of the Copepoda has been made in relatively few areas and the only region that can be said to be reasonably well known

† Wilson records this species among the North American Caligidæ, but gives no locality.

comprises the coasts of Europe, around which Giesbrecht (1899 and 1900) and others (*vide infra*, p. 180) have studied the Mediterranean region; Canu (1892) and Norman and T. Scott (1906) have investigated the English Channel; Brady (1880), T. Scott (1892 to 1904), Pearson (1905) and Norman and Brady (1909) have given us numerous observations round the coasts of the British Isles; Sars (1913–18 and 1921) has made a detailed study of the coasts of Norway; and T. Scott (1901 and 1903) and Hansen (1923) have recorded observations from the Arctic area. With the exception of a few observations made by T. Scott (1894) in the Gulf of Guinea, we know practically nothing of the South Atlantic area. As we proceed eastward our knowledge gets less and less. In the Indian Ocean and its offshoot the Red Sea we have observations by Kossmann (1877), A. Scott (1902), Schellenberg (1922) and Gurney (1927) from the Red Sea and the Suez Canal; Thompson and A. Scott (1903) have carefully studied the Ceylon Pearl Banks; the present records are from the Arabian Sea, the Maldive and Laccadive Archipelagos, together with a few records from the Andaman and Nicobar Islands; and Stebbing (1910) has given some records from the South African Region. In the western Pacific region Thomson (1883) and Brady (1899) have given some records from New Zealand; A. Scott (1909) has also given some records from the Malay Archipelago, but these are derived almost entirely from tow-nettings; and Yamaguti (1936) has given us records from Japan; but we know practically nothing of the east Pacific fauna. Finally, Nicholls (1944) has studied the South Australian region, and Giesbrecht (1902), Brady (1910) and T. Scott (1912) have given a number of records from the Antarctic Ocean.

Such records as are available indicate that a few species possess a wide range; *Euryte longicauda* Philippi, *E. robusta* Giesbrecht, *Halicyclops æquoreus* Fischer (= *H. magniceps* Lillj.), *Monstrilla helgolandica* Claus, *M. longicornis* Thompson and *M. gracillicauda* Giesbrecht seem to range from the Pacific Ocean to the North Atlantic and even on into the Arctic region, while *Macrochiron hirsutipes* T. Scott, *Pseudanthessius liber* Brady and Robertson, *P. gracilis* Claus, *Dermatomyzon nigripes* Brady and Robertson, *Ascomyzon* (*Asterocheres*) *stimulans* Giesbrecht, *A. minutus* Claus, *Scottocheres elongatus* T. and A. Scott, *Artotrogus orbicularis* Boeck, *Doropygus pulex* Thorell, *Cymbasoma thompsoni* Giesbrecht (? = *C. tropicus* (Wolf.)) and *Hæmocera danæ* Claparède appear to range from the Indian Ocean to the coast of Norway and even as far as the Arctic; of these the species belonging to the genera *Euryte*, *Halicyclops*, *Monstrilla*, *Cymbasoma* and *Hæmocera* are all free swimming in the adult stage and the first two genera are so throughout life, while other species such as *Macrochiron hirsutipes* T. Scott, *Dermatomyzon nigripes* Brady, *Scottocheres elongatus* T. and A. Scott and *Artotrogus orbicularis* Boeck are known to frequent weed and thus may have been transported by oceanic surface currents. The great majority of species, so far as we know at present, appear to have a limited range, and in many cases are confined to a single geographical region. As a consequence of this the number of species that appear to be endemic in each area is, in comparison with the Epiplanktonic Calanoids or the Weed-haunting Harpacticids, remarkably high.

Our knowledge of the littoral and semi-parasitic species that occur on the coasts of the Pacific Ocean in somewhat scanty, and this is particularly the case as regards the east Pacific region and the west coast of America; the only records that I have been able to find of species belonging to the groups under review are contained in the following papers: Haddon, 1912; Fraser, 1920; Wilson, 1908, 1912, 1935*b*, 1938; and Campbell, 1929. The species recorded from the western coast of America are as follows:

CYCLOPOIDA.

SIPHONOSTOMA.

ASCOMYZONTIDÆ.

Ascomyzon rubrum Campbell.

CANCERILLIDÆ.

Cancerilla tubulata Dalyell.

PŒCILOSTOMA.

CLAUSIDIIDÆ.

Clausidium californiense Wilson.
Hemicyclops callianassæ Wilson.
H. thysanotus Wilson.
Hersilia (*Clausidium*) *vancouverensis* Haddon.

LICHOMOLGIDÆ.

Macrochiron sargassi Sars.
Modiolicola gracilis Wilson.
Pseudanthessius obscurus A. Scott.
Pseudomolgus sp. Wilson.
P. navanacis Wilson.

ERGASILIDÆ.

Ergasilus turgidus Fraser.
Mytilicola ostræa Wilson.

BOMOLOCHIDÆ.

Artocolax (*Bomolochus*) *ardeolæ* Kröyer.

NOTODELPHYOIDA.

DOROPYGIDÆ.

Doropygus pulex Thorell.
Doropygopsis longicauda (Aurivillius).

A further species belonging to the eastern or central Pacific region is *Pseudomolgus hawaiiensis* Wilson, recorded, as its name implies, from Hawaii.

Among the above species *Doropygus pulex* Thorell appears to have a world-wide distribution and has been recorded from the Arctic region, and *Cancerilla tubulata* Dalyell and *Doropygopsis longicauda* (Aurivillius) are known from the north-east Atlantic region, the former from the coasts of the British Isles and Norway, and the latter from Norway, the Baltic and the Barents Sea area, and a fourth species, *Macrochiron sargassi* Sars, was originally described from the North Atlantic Ocean. These facts suggest that there is or has been in the past a connection between the northern and boreal regions of the Atlantic Ocean and the west coast of North America, and since the majority of these species are northern in their distribution, it seems possible that their present-day distribution has been

brought about by a transference *via* an Arctic route and through the Bering Strait, perhaps at a time when conditions in these regions were somewhat warmer than they are to-day, as just after the close of the last Glacial period, rather than by the older, tropical route between North and South America, when this lay open during the Miocene epoch before North and South America became united.

I have been able to collate references to the occurrence in the west Pacific area of 86 species belonging to the Groups under review (*vide*, Thomson, 1883 ; Bassett-Smith, 1899 ; Brady, 1899 ; Stebbing, 1900 ; Embleton, 1901 ; Sars, 1905 ; A. Scott, 1909 ; Früchtl, 1924 ; Leigh-Sharpe, 1934 ; Smirnov, 1935 *a* and *b* ; Yamaguti, 1936 and 1937 ; Markewitsch, 1935 ; and Dakin and Colefax, 1940).

CYCLOPOIDA.

Cyclopina brachystylis Sars,
C. pacifica Smirnov,
C. pusilla Sars,
C. steueri Früchtl,
Paracyclopina nana Smirnov,
Cyclopinopsis curticauda Smirnov,
Euryte longicauda Philippi,
? *E. robusta* Giesbrecht,
Halicyclops æquoreus Fischer (? = *H. christianensis* (Boeck)),
H. propinquus Sars,
H. sinensis Kiefer,
H. thermophilus Kiefer,
Ascomyzon boecki Brady (= *Asterocheres b.*),
Mimacheres collyra Leigh Sharpe,
Acontiophorus zealandicus Nicholls (? = *A. scutatus* Thomson, *non* Brady),
Pontœciella abyssicola (T. Scott),
Artotrogus ovatus Thomson,
A. brevicaudatus Brady,
Cancerilla neozeylanica Stephensen,
Hemicyclops leggii Thompson and A. Scott,
Paurocope robusta Brady,
Entomolepis ovalis Brady,
" *Saphirella abyssicola* " T. Scott,
" *S. tropica* " Wolfenden,
Pseudomyicola ostreæ Yamaguti,
Lichomolgus anomalus A. Scott,
L. brevicaudis Leigh-Sharpe,
L. elegans Thompson and A. Scott,
L. gigas Thompson and A. Scott,
L. gracilipes A. Scott,
L. orbicularis Monod,
L. pleurobranchi (Kossmann) (= *Stellicola p.*).
L. spondyli Yamaguti,

Stellicola semperi Kossmann,
Linckiomolgus cæruleus (Stebbing),
Paralichomolgus curticaudatus Thompson and A. Scott,
Kelleria pectinatus (A. Scott),
K. regalis Gurney,
Macrochiron (*Macrochiron*) *alabatensis* (Kossmann),
M. (*M.*) *buddhensis* (Thompson and A. Scott),
M. (*Paramacrochiron*) *parvum* (A. Scott) (= *Pseudanthessius p.*),
Pseudanthessius obscurus A. Scott,
P. weberi A. Scott,
Anthessius concinnus (A. Scott) (= *Pseudomolgus c.* A. Scott),
A. hawaiensis (Wilson) (= *Pseudomolgus h.* Wilson),
Ergasilus hypomesi Yamaguti,
E. mugilis Vogt,
E. orientalis Yamaguti,
E. peregrinus Heller,
E. plecoglossi Yamaguti,
E. wilsoni Markevitsch,
Pseudergasilus zacconis Yamaguti,
Panaietis haliotis Yamaguti,
P. incamerata Stebbing,
Philoconcha amydalæ Yamaguti,
P. paphiæ Yamaguti,
Paraphiloconcha meretricis Yamaguti,
Mytilicola orientalis Mori,
Bomolochus chattoessi Kröyer,
B. decapteri Yamaguti,
B. efficatus Leigh-Sharpe,
B. gracilis Heller,
B. megaceros Heller,
B. (*Pseudobomolochus*) *managaturo* Yamaguti,
Goidelia japonica Embleton,
Conostoma elliptica Thomson,
Mantra speciosa Leigh-Sharpe.

NOTODELPHYOIDA.

Notodelphys matronalis Leigh-Sharpe,
Doropygus novæsealandicus Schellenberg,
D. trisetosus Schellenberg,
Bonierilla brevipes Schellenberg,
Parabotryllophilus arrisio Leigh-Sharpe,
Aplostoma gibbera Stellinberg.

MONSTRILLOIDA.

Monstrilla cymbula A. Scott,
M. gracillicauda Giesbrecht,

M. helgolandica Claus (= *M. serricornis* Sars),
M. inserta A. Scott,
M. longicornis Thompson,
M. longipes A. Scott,
M. orcula A. Scott,
M. turgida A. Scott,
M. viridis Dana,
Cymbasoma bullatus A. Scott,
C. gigas A. Scott,
C. longispinosum (Bourne),
C. thompsoni (Giesbr.),

and perhaps to these should be added *Mytilicola ostreæ* Wilson, which was discovered in Puget Sound in Japanese oysters that had been transplanted to the Pacific coast of the United States of America.

A few of the above species are of doubtful validity. Giesbrecht (1899) was unable to recognize from the descriptions given either *Artotrogus bœcki* or *Conostoma elliptica*, both of which were recorded by Thomson from the coast of New Zealand; and Monod and Dollfuss (1932) regard *Stellicola semperi* Kossmann as synonymous with *Linckiomolgus cœruleus* Stebbing, but with this view I am inclined to disagree. We are thus left with 84 species that are known from this area.

A comparison of the west Pacific fauna and that of the north-east Atlantic region indicates that there are some 10 or 12 species that are common to both regions, namely :

Cyclopina brachystylis Sars.
Euryte longicauda Philippi.
E. robusta Giesbr.
? *Halicyclops æquoreus* Fischer.
? *H. propinquus* Sars.
Asterocheres bœcki (Brady) (= *Ascomyzon b.* Brady).
Ergasilus mugilis Vogt.
Monstrilla gracillicauda Giesbr.
M. helgolandica Claus (= *M. serricornis* Sars).
M. longicornis Thompson.
Cymbasoma longispinosum (Bourne).
C. thompsoni (Giesbr.).

Of the above the presence of the two species of *Halicyclops* in both areas is open to some doubt. Kiefer (1935) has indicated that several different species have in the past been confused under the name *Halicyclops æquoreus* Fischer, and Gurney (1931–33) has expressed the opinion that *H. propinquus* Sars is merely a variety, or possibly a subspecies, of *H. æquoreus*. Of the remaining 10 species, 6 have been recorded from the Indian Ocean, 7 from the Mediterranean Sea, and the same number from the British Isles and the neighbouring coast of France, and 9 from the coasts of Norway. As already mentioned (*vide supra*, p. 160) the great majority of the above are free swimming in the adult stage and have a wide distribution, and may have been transported by the present-day oceanic currents, in a manner similar to the planktonic Copepoda, through the Indian Ocean and the Atlantic Ocean.

Cyclopina pacifica Smirnov was taken off Petropavlovsk in Kamchatka, *Cyclopinopsis curticauda* Smirnov came from Awatscha Bay in the same region, and *Paracyclopina nana* Smirnov was taken in brackish water in the Vladivostok region, from which locality *Cyclopina brachystylis* Sars has also been taken. It is possible that all four species should be regarded as northern boreal or even arctic species rather than pacific, and they may have been carried southwards through the Bering Strait.

Turning now to the region of the Indian Ocean and its offshoot the Red Sea, thanks to the work of Kossmann (1877), Bassett-Smith (1899), A. Scott (1902), Thompson and A. Scott (1903), Wolfenden (1906), Schellenberg (1922), Gurney (1927), Lindberg (1941, *a* and *b*) and the present collections, we now have records of no less than 133 species that are known to be present in this region. McIntosh (1906) and Stebbing (1910) have given records of 5 species that have been taken in the region of the Cape of Good Hope, and I have included these in the following list of species :

CYCLOPOIDA. Section GNATHOSTOMA.

Family Cyclopinidæ.

Genus *Cyclopina* Claus.

Cyclopina gracilis Claus.
C. intermedia Sewell.
C. longifurca Sewell.
C. minuta Sewell.

Genus *Cyclopetta* G. O. Sars.

Cyclopetta orientalis Lindberg.

Genus *Pterinopsyllus.*

Pterinopsyllus egregius Giesbrecht.

Family Cyclopidæ.

Genus *Euryte* Philippi.

Euryte brevicauda sp. nov.
E. longicauda Philippi.
E. robusta Giesbrecht.

Genus *Eurycyclops* nov.

Eurycyclops magna sp. nov.
E. parva sp. nov.

Genus *Neocyclops* Gurney.

Neocyclops salinarum Gurney.

Genus *Halicyclops* Norman.

Halicyclops christianensis (Boeck) (= *H. æquoreus* Fischer).
H. canui Lindberg.
H. tenuispina Sewell.
H. thermophila spinifer Kiefer.

Section SIPHONOSTOMA.

Family Asterocheridæ (= Ascomyzontidæ).

Genus *Asterocheres* Boeck (= *Ascomyzon* Thorell).

Asterocheres dentatus Giesbrecht.

A. lilljeborgii Thorell.
A. major Thompson and A. Scott.
A. manaarensis Thompson and A. Scott.
A. micheli Gurney.
A. minor Thompson and A. Scott.
A. minutus Claus.
A. ovalis sp. nov.
A. stimulans Giesbrecht.

Genus *Dermatomyzon* Claus.

Dermatomyzon nigripes Brady.

Genus *Collocheres* Canu.

Collocheres giesbrechti Thompson and A. Scott.

Genus *Scottocheres* Giesbrecht.

Scottocheres elongatus (T. and A. Scott).
S. longifurca Giesbrecht.

Family Acontiophoridæ.

Genus *Acontiophorus* Brady.

Acontiophorus maldivensis sp. nov.

Family Dyspontiidæ.

Genus *Bradypontius* Giesbrecht.

Bradypontius siphonatus Giesbrecht.

Genus *Cryptopontius* Giesbrecht.

Cryptopontius innominatus Brady.

Genus *Pteropontius* Giesbrecht.

Pteropontius quartus sp. nov.

Genus *Asteropontius* Thompson and A. Scott.

Asteropontius attenuatus Thompson and A. Scott.
A. nicobaricus sp. nov.
A. typicus Thompson and A. Scott.

Genus *Lepeopsyllus* Thompson and A. Scott.

Lepeopsyllus ovalis Thompson and A. Scott.
L. typicus Thompson and A. Scott.

Genus *Doropontius* Thompson and A. Scott.
Doropontius denticornis Thompson and A. Scott.

Genus *Cletopontius* Thompson and A. Scott.
Cletopontius serratus Thompson and A. Scott.

Family Artotrogidæ.

Genus *Artotrogus* Boeck.
Artotrogus orbicularis Boeck.

Genus *Obesiella* Ridewood.
Obesiella lyonsiellæ Ridewood.

? Family Cancerillidæ.

Genus *Stephopontius* Thompson and A. Scott.
Stephopontius typicus Thompson and A. Scott.

Section PŒCILOSTOMA.

Family Clausidiidæ.

Genus *Hemicyclops* Boeck.
? *Hemicyclops dubia* (Thompson and A. Scott).
H. indicus sp. nov.
H. leggii Thompson and A. Scott.
H. tamilensis Thompson and A. Scott.
" *Saphirella tropica* " Wolfend.
" *S. indica* " Sewell.
" *S. nicobarica* " sp. nov.

Family Lichomolgidæ.

Genus *Lichomolgus* Thorell.
Lichomolgus anomalus A. Scott.
L. ægyptius Gurney.
L. dentipes Thompson and A. Scott.
L. elegans Thompson and A. Scott.
L. foxi Gurney.
L. gigas Thompson and A. Scott.
L. gracilis Thompson and A. Scott.
L. jeversi Thompson and A. Scott.
L. lankensis Thompson and A. Scott.
L. minor A. Scott.
L. robustus Thompson and A. Scott.
L. rotundatus sp. nov.
L. simplex Thompson and A. Scott.

Genus *Stellicola* Kossmann.
Stellicola oreastriphilus Kossmann.
S. semperi Kossmann.
S. thorelli Kossmann.

Genus *Paralichomolgus* Thompson and A. Scott.

Paralichomolgus curticaudatus Thompson and A. Scott.
P. longicaudatus Thompson and A. Scott.

Genus *Kelleria* Gurney.

Kelleria andamanensis sp. nov.
K. camortensis sp. nov.
K. gurneyi sp. nov.
K. purpurocincta Gurney.
K. regalis Gurney.

Genus *Macrochiron* Brady.

Subgenus *Macrochiron*.

Macrochiron (*Macrochiron*) *buddhensis* (Thompson and A. Scott).
M. (*M.*) *hirsutipes* T. Scott.
M. (*M.*) *longipes* sp. nov.
M. (*M.*) *spinipes* sp. nov.

Subgenus *Paramacrochiron* nov.

Macrochiron (*Paramacrochiron*) *chelifer* (Thompson and A. Scott).
M. (*P.*) *malayensis* sp. nov.
M. (*P.*) *maximus* (Thompson and A. Scott).
M. (*P.*) *parvum* (A. Scott).

Genus *Pseudanthessius* Claus.

Pseudanthessius gracilioides sp. nov.
P. gracilis Claus.
P. liber Brady and Robertson.
P. mucronatus Gurney.
P. obscurus A. Scott.
P. thorelli Brady and Robertson (= *concinnus* Thompson and A. Scott).

Genus *Nasomolgus* nov.

Nasomolgus cristatus sp. nov.

Genus *Herrmannella* Canu.

Herrmannella robusta Thompson and A. Scott.
H. serendibica Thompson and A. Scott.

Genus *Preherrmannella* nov.

Preherrmannella adduensis sp. nov.
P. brevicauda sp. nov.
P. nicobarica sp. nov.

Genus *Anthessius* Della Valle (= *Pseudomolgus* Sars).

Anthessius arenicolus (Brady and Robertson).
A. brevifurca sp. nov.

Genus *Sabelliphilus* M. Sars.

Sabelliphilus sarsi Claparède (= *elongatus* M. Sars).
S. leuckarti Kossmann.
S. (?) *bispiræ* McIntosh.

Family Ergasilidæ.

Genus *Ergasilus* Norman.

Ergasilus bengalensis Southwell and Prashad.
E. hamiltoni Southwell and Prashad.
E. nanus van Beneden.

Genus *Assecula* Gurney.

Assecula caligiformis Gurney.

Family Clausiidæ.

Genus *Panaietis* Stebbing (= *Conchocheres* Sars).
Panaietis incamerata Stebbing.

Family Bomolochidæ.

Genus *Bomolochus* Nordmann.

Bomolochus denticulatus Bassett-Smith.
B. scomberesocis Kröyer.
B. tetrodontis Bassett-Smith.
B. triceros Bassett-Smith.
B. unicirrus Richiardi.

NOTODELPHYOIDA.

Family Notodelphyidæ.

Genus *Notodelphys* Allman.

Notodelphys ciliata Schellenberg.
N. pachybrachia Schellenberg.
N. parva Schellenberg.

Genus *Pseudonotodelphys* Gurney.

Pseudonotodelphys phallusiæ Gurney.

Genus *Paranotodelphys* Schellenberg.

Paranotodelphys gracilis Schellenberg.

Family Doropygidæ.

Genus *Doropygus* Thorell.

Doropygus cylindriformis Schellenberg.
D. longimatrix Schellenberg.
D. novemsetiferus Schellenberg.
D. normani Brady.
D. pulex Thorell.

Genus *Bonnierilla* Canu.

Bonnierilla acollaris Schellenberg.

Genus *Notopteropheroides* Schellenberg.

Notopteropheroides malacodermatus Schellenberg.

Genus *Gunentophorus* Costa.

Gunentophorus globularis Costa.

Genus *Botryllophilus* Hesse.

Botryllophilus indicus sp. nov.
B. ruber Hesse.

Genus *Zanclopus* Calman.

Zanclopus cephalodisci Calman.

MONSTRILLOIDA.

Section CYCLOMORPHA.

Family THESPESIOPSYLLIDÆ.

Genus *Orientopsyllus* gen. nov.

Orientopsyllus investigatoris sp. nov.

Section MONSTRILLOIDA GENUINA.

Family MONSTRILLIDÆ.

Genus *Monstrilla* Dana.

Monstrilla anglica Lubbock.
M. ? conjunctiva Giesbrecht.
M. helgolandica Claus.
M. investigatoris sp. nov.
M. longipes A. Scott.

Genus *Cymbasoma* Thompson.

Cymbasoma nicobarica sp. nov.
C. tropicus (Wolfenden) (? = *C. thompsoni* Giesbrecht).

Genus *Hæmocera* Malaquin.

Hæmocera danæ (Clap.) Malaquin.

Reference to the Bathymetric Chart (Chart I) shows that there is a close connection between the east Indian and the south-west Pacific regions. The great Sunda Shelf, which includes the Malay Peninsula and the islands of Sumatra, Java, Borneo and Celebes, and over which there is a depth of water of less than 200 m., comes into close connection with the Sahul Shelf, on which are situated the continent of Australia and the outlying island of New Guinea ; and the Philippine Islands, the Sulu Archipelago and the Timor and Ceram Arcs form close stepping-stones from one shallow-water region to the other, and

all are directly connected together at a depth of less than 2000 m. There is therefore in this area a dispersal route that can present little or no difficulty for a littoral-haunting species to pass from one region to another, and this, taken in conjection with the fact that there is every six months, with the reversal of the monsoon winds from North-east to South-west, a complete reversal of the surface currents, will provide a perfectly adequate explanation for the presence of the same species in both the Pacific and Indian Oceans. A comparison of the lists of species present in these two areas reveals that as many as 19 are common to both, namely :

Euryte longicauda Philippi.
E. robusta Giesbrecht.
? *Halicyclops christianensis* (Boeck).
H. thermophilus Kiefer.
Hemicyclops leggii Thompson and A. Scott.
" *Saphirella tropica* " Wolfenden.
Lichomolgus anomalus A. Scott.
L. elegans Thompson and A. Scott.
L. gigas Thompson and A. Scott.
Stellicola semperi Kossmann.
Kelleria regalis Gurney.
Macrochiron (*Macrochiron*) *buddhensis* Thompson and A. Scott.
M. (*Paramacrochiron*) *parvum* A. Scott.
Paralichomolgus curticaudatus Thompson and A. Scott.
Pseudanthessius obscurus A. Scott.
Panaietis incammerata Stebbing.
Monstrilla helgolandica Claus.
M. longipes A. Scott.
? *Cymbasoma thompsoni* (Giesbr.) (= *Thaumaleus tropicus* Wolfend.).

We thus have some 22 per cent. of the known west Pacific fauna present in the Indian region.

A study of the planktonic Copepoda and of the littoral and weed-haunting Harpacticoida (*vide* Sewell, 1940*a* and 1948) reveals that there is a considerable degree of resemblance between the faunas of the South-west Pacific and Indian regions on the one hand and the South Australian region on the other. Balss (1935), in his report on the Decapod Crustacea of South-west Australia, has pointed out that the warm-water sub-tropical fauna of the Indo-Pacific region extends along the north coast of Australia and down the west coast as far as Sharks Bay, and on the east coast as far south as Sydney or even farther. On the south Australian coast a cold-water fauna extends from the Freemantle area on the west, along the south coast and then up the east coast as far as Sydney, where a typical " Misch-fauna " occurs : this is very much what one would expect to find in view of the fact that during a part of the year, and especially in the months of August and September, the surface current along the south Australian coast sets eastward from the Indian Ocean (*vide* Schott, 1935, pl. xxx), and this water is largely derived from the West Wind Drift, and has an average temperature ranging from 13·6° C. to 15·2° C. During the months of February and March, however, the current sets in the opposite direction and flows west-

ward from the Pacific Ocean and more particularly from the Tasman Sea, and the average temperature is from 17·5° C. to 20·4° C. (*vide* Koninklijk Nederlandsch Meteorologisch Institute, No. 104 : Oceanographische en Meteorologische Waarnemungen in den Indisches Oceaan, 1927–30). This westwardly flowing current brings some, at least, of the south-west Pacific fauna to the South Australian coast, so that out of 11 species of Calanoids recorded by Nicholls (1944) from the Spencer Gulf region, 5, or 45 per cent., are known to occur in the Indo-Pacific region, and one other species, *Labidocera cervi* Krämer, is at present known only from New Zealand and the Australian coast at Melbourne Harbour and in Spencer Gulf. Brehm (1936) has called attention to the probability that at some period in the past there was a close connection between New Zealand and the South-east corner of Australia, as is clearly indicated by the present-day distribution of the genera *Gladioferens* Henry and *Calamœcia* Brady.

Among the littoral-haunting Harpacticids there is also a moderate degree of relationship between the South Australian and the South-west Pacific faunas : Nicholls (1941) has recorded 26 species from the Spencer Gulf region, and of these at least 8, or 31 per cent., are known from the Indo-West Pacific area. It seems possible that the relationship is even closer than this, for the species that Nicholls has described as new under the name *Amphiascopsis australis* appears to me to be in all probability the same as the form that I have recorded from the Indian Ocean as *Amphiascus cinctus* (Claus). Furthermore, Nicholl's *Tydemanella robustus* comes very near to *Ialysus investigatoris* Sewell.

Nicholls (1941*a*, p. 416) at first regarded the genera *Tydemanella* A. Scott and *Ialysus* Brian as synonyms, the former name having priority ; and in *Tydemanella* he included three species, namely *typica* A. Scott, *rufus* (Brian) and *robusta* Nicholls ; but in a later paper (Nicholls, 1941*b*, p. 90) he revised his view, and not only again separated *Tydemanella* and *Ialysus* as two valid genera, but added a third closely related genus, *Parialysus*, to accommodate his species *robustus* (Nicholls). *Ialysus investigatoris* Sewell, and probably *I. propinquus* Sewell, which at present is known only from the male, will have to be transferred to Nicholl's new genus *Parialysus*, for they are clearly closely related to *Parialysus robustus*, though a glance at the setal formulæ for the two species seems at first to reveal a marked degree of difference, but a further study shows that one or other of us has confused the various legs : thus,

	Endopod.	Exopod.	
Nicholls, p. 2.	1 . 1 . 121	0 . 1 . 222	corresponds to my p. 4.
,, p. 3.	1 . 2 . 221	0 . 1 . 322	,, ,, p. 2.
,, p. 4.	1 . 1 . 221	0 . 1 . 322	,, ,, p. 3.

One might thus reasonably expect to find that some, at least, of the semi-parasitic and parasitic Copepoda that have been recorded from the south-west Pacific area, and particularly from New Zealand, would also occur on the coast of South Australia. Nicholls (1944) has recorded 18 species from this latter area but, with the single possible exception of *Acontiophorus zealandicus* Nicholls, that is probably the form recorded by Thomson (1883) from New Zealand as *A. scutatus* Brady and Robertson, all are new to science. A comparison of the South Australian and the Antarctic faunas reveals an equally marked difference, for in the groups under review not a single species is common to the two areas.

I give below in parallel columns the species that have so far been recorded from the two regions :

South-east and South Australia.	*Antartica.*
CYCLOPOIDA.	*CYCLOPOIDA.*
CYCLOPIDÆ.	CYCLOPIDÆ.
. .	*Cyclopina belgica* Giesbrecht.
. .	*Cyclops glacialis* Brady.
. .	*Euryte longicauda* Philippi.
. .	*E. propinquus* Brady (? = *E. robustus* Giesbr. and *E. similis* T. Scott).
ASTEROCHERIDÆ.	ASTEROCHERIDÆ.
. .	*Asterocheres antarctica* T. Scott.
. .	*A. suberitis* Giesbr. var.
. .	*A. tenuicornis* Brady.
. .	*Dermatomyzon giesbrechti* Brady.
. .	*D. herdmani* Brady.
. .	*D. imbricatum* Brady.
. .	*Collocheres dubia* Brady.
Australomyzon typicus Nicholls.	. .
Scottocheres latus Nicholls.	. .
Acontiophorus zealandicus Nicholls.	. .
MYZOPONTIIDÆ.	MYZOPONTIIDÆ.
Myzopontius australis Nicholls.	. .
DYSPONTIIDÆ.	DYSPONTIIDÆ.
. .	*Dyspontius latus* Brady.
. .	*Urogonia typica* Brady.
Cryptopontius latus Nicholls.	*Cryptopontius innominatus* Brady.
C. longipes Nicholls.	. .
C. proximus Nicholls.	. .
C. similis Nicholls.	. .
. .	*Dystrogus uncinatus* Brady.
Pteropontius barbatus Nicholls.	*Pteropontius scaber* Brady.
Discopontius discoides Nicholls.	. .
Bradypontius inermis Nicholls.	*Bradypontius ignotus* Brady.
B. ovatus Nicholls.	*B. serrulatus* Brady.
B. serratipes Nicholls.	. .
ARTOTROGIDÆ.	ARTOTROGIDÆ.
Artotrogus latifurcatus Nicholls.	*Artotrogus australis* Wilson.
. .	*A. gigas* Brady.
. .	*A. proximus* T. Scott.
. .	*A. sphæricus* Brady.
. .	*Selioides tardus* Gravier.

South-east and South Australia.	*Antartica.*
CLAUSIDIIDÆ.	CLAUSIDIIDÆ.
Hemicyclops australis Nicholls.	..
" *Saphirella tropica* " Wolfenden.	..
LICHOMOLGIDÆ.	LICHOMOLGIDÆ.
..	*Pseudomolgus* sp.
..	*Lichomolgus tenuicornis* Brady.
..	*L. fuliginosus* Brady.
Paranthessius propinquus Nicholls.	..
P. tenuis Nicholls.	..
CORYCÆIDÆ.	CORYCÆIDÆ.
..	*Ratania atlantica* Farran.
	? Family.
	Selioides tardus Gravier.
NOTODELPHYOIDA.	*NOTODELPHYOIDA.*
NOTODELPHYIDÆ.	NOTODELPHYIDÆ.
..	*Notodelphys antarctica* Brady.
..	*Aplostoma magellanica* Chatton and Brément (Cape Horn).
Notodelphyopsis variabilis Schellenberg.	..
Paranotodelphys scutiformis Schellenberg.	*Paranotodelphys longicauda* Schellenberg.
Notopteropheroides armadillo Schellenberg.	..
Doropygus spiniferus Schellenberg.	*Doropygus antarcticus* Schellenberg.
..	*D. kerguelensis* Schellenberg.
..	*D. lamellipes* Schellenberg.
Bonierilla acollaris Schellenberg.	..
B. armata Schellenberg.	..
..	*Zanclopus antarcticus* Gravier.
ANOMOPSYLLIDÆ.	ANOMOPSYLLIDÆ.
Dysgenopsyllus reevesbyensis Nicholls.	..
MONSTRILLOIDA.	*MONSTRILLOIDA.*
MONSTRILLIDÆ.	MONSTRILLIDÆ.
Monstrilla sp.	*Monstrilla conjunctiva* Giesbrecht.
..	*M. mixta* T. Scott (Falkland Is.).
Cymbasoma longispinosum (Bourne).	..
C. thompsoni Giesbrecht.	..

We thus have 27 species recorded from the south-east and south coasts of Australia and 33 species from the Southern Ocean and Antarctica, but there is not a single species that is common to both regions.

One barrier to the spread of species from the tropical region of the South-west Pacific area to the sub-tropical region of the South coast of Australia and thence to the cold region of Antarctica, or *vice versa*, is to be found at the present day in the temperature of the water in these different regions and the direction of flow of the surface currents; Wolfenden (1911, p. 375) has called attention to the difficulty experienced by the warm-water planktonic species of the Calanoida in migrating into the Antarctic region, and I (Sewell, 1940) have pointed out that the same difficulty seems to be experienced by the littoral and weed-haunting Harpacticids. A further difficulty is to be found in the bottom-topography. Although the cool-water fauna of the south Australian coast might be swept eastward by the West Wind Drift towards New Zealand, and thus be enabled to spread northwards into the island region of the south-west Pacific ocean, a study of the bottom contours shows that at the present day there is no direct connection between Australia and the bank on which New Zealand stands at any depth less than 3000 m. (*vide* Chart I), and, as I have already pointed out (*vide supra*, p. 155), this seems to be the extreme bathymetric limit at which these forms can survive. Furthermore, to reach the north-east part of Australia, and to gain access to the great Sunda Plateau, these forms would have to pass up the east coast of Australia against the general trend of the surface current. Between Australia and Antarctica there is a deep connecting ridge on which stand Macquarie and Campbell Islands, but here too the depth of water is greater than 3000 m. except at the isolated points of Mill Bank and the Macquarie Shelf. It thus appears to be extremely difficult, if not impossible, for species at the present day to migrate from one area to another; but if we consider, not the species but the genera, we see that in the south Australian region we have records of 20 genera and in the Antarctic region of 22, and of these 7 are common to both regions. It would appear therefore that during some past era a passage between South Australia and Antarctica has been possible, but that since then separation by deep water has separated the two regions, with the result that each area has developed its own endemic species.

A further point of interest is the occurrence in the Antarctic and off South Africa of two species of the genus *Zanclopus*, *Z. antarctica* Gravier and *Z. cephalodisci* Calman. As the genus is unknown from any other region, this distribution suggests the possibility that in some previous era there was a shallow water connection between these two land masses.

In previous papers (Sewell, 1940 and 1941) I have pointed out that in both the littoral and weed-haunting Harpacticids and in the epiplanktonic Copepoda the general trend of dispersal seems to have been from east to west, and it is thus probable that the 19 species that are common to both the south-west Pacific and the Indian regions (*vide supra*, p. 171) have been carried westward from the Pacific to the Indian Ocean; some, indeed, have succeeded in getting far beyond the limits of this latter region, and these are members of a group that has a very wide range, and have been taken in the Mediterranean Sea and in the north Atlantic Ocean on the coasts of the British Isles and the English Channel. These species are

Euryte longicauda Philippi.
E. robusta Giesbrecht.

? *Halicyclops æquoreus* Fischer (? = *H. christianensis* (Boeck).
Monstrilla gracillicauda Giesbrecht.
M. helgolandica Claus.
M. longicornis Thompson.
Cymbasoma longispinosum (Bourne).
C. thompsoni (Giesbrecht).

As Sars has pointed out, it is surprising that *Euryte robusta* Giesbrecht has so far not been recorded from the coasts of the British Isles, but in view of the fact that, like *Euryte longicauda* Philippi, it is now known to occur on the coast of Norway, it seems highly probable that it will ultimately be found among the British fauna, and I have therefore included it in the above list. *Monstrilla helgolandica* Claus has been taken in the south-west Pacific region, in the Indian Ocean and round the British Isles and the North Sea, though it has not as yet, so far as I am aware, been recorded from the Mediterranean Sea Two other species from the west Pacific area have been taken in the Mediterranean Sea, namely *Cyclopina steueri* Früchtl and *Pontœciella abyssicola* (T. Scott), and the latter species has also been recorded from the Gulf of Guinea and the Bay of Biscay in the Atlantic area ; but neither has, as yet, been recorded from the Indian Ocean.

At the present time the number of species that have been recorded from the Indian Ocean but have not been taken in areas lying further to the east is 74 : since the main trend of distribution is, as I have already mentioned, probably from east to west, I have for the purpose of this review assumed that these species have had their origin in the Indian Ocean, though it is probable that further researches in the Pacific Ocean will reveal the presence of some, at least, of these forms in that region. A number of these Indian species have been taken in the Mediterranean Sea, namely :

**Cyclopina gracilis* Claus.
Pterinopsyllus egregius Giesbrecht.
**Euryte longicauda* Philippi.
E. robusta Giesbrecht.
? **Halicyclops æquoreus* Fischer (? = *H. magniceps* Auct.).
Asterocheres dentatus Giesbrecht.
A. minutus Claus.
**A. stimulans* Giesbrecht.
**Dermatomyzon nigripes* Brady.
**Scottocheres elongatus* T. Scott.
S. longifurca Giesbrecht.
Bradypontius siphonatus Giesbrecht.
**Artotrogus orbicularis* Boeck.
**Pseudanthessius gracilis* Claus.
**Anthessius arenicolus* Brady (= *Pseudomolgus arenicola*).
**Sabelliphilus elongatus* M. Sars (= *S. sarsi* Clap.).
**Ergasilus nanus* van Beneden.
**Doropygus normani* Brady.
**D. pulex* Thorell.
**Gunentophorus globularis* Costa.
? **Thaumaleus tropicus* Wolfenden (? = *Cymbasoma thompsoni* Gies.).

Of the above 20 or 21 species, the majority, 14 (or 15), marked with an *, have been recorded from the coasts of the British Isles and English Channel and some even from as far north as the coast of Norway. Among the epiplanktonic Copepoda and the Weed-haunting Harpacticids a number of species appear to have succeeded in reaching these northern areas by being carried first westward from the Indian Ocean past the Cape of Good Hope into the South Atlantic Ocean, then westward again by the South Equatorial Current across the Atlantic to the coasts of America, and finally eastward across the North Atlantic to the British Isles and Norway by the Gulf Stream and North Atlantic Drift: but for these littoral-haunting, semi-parasitic forms such a course appears to be ruled out by their apparent inability to cross any deep arm of the ocean, and not one of the above species, with the possible exception of *Halicyclops magniceps* (Lilljeb.) has so far been recorded from the American coast. It has been suggested that *Pontæciella abyssicola* (T. Scott) is a relict of the fauna of the Tethys Sea that in Eocene and Miocene times connected the Indo-Pacific region with the North Atlantic, and the same explanation might equally well account for the presence of the above Indian species in the Mediterranean Sea and round the British Isles. That the extension of their range of distribution from the Indian Ocean into the Mediterranean Sea has not occurred in recent times is indicated by the fact that of all the species that appear to have had their origin in the Indian Ocean (*vide supra*, p. 165) only four are known to have reached the Red Sea, namely:

Neocyclops salinarum Gurney,
Lichomolgus minor A. Scott,
Macrochiron (*Paramacrochiron*) *chelifer* (Thompson and A. Scott),
Asterocheres micheli (Gurney),

and not one of these occurs in the previous list. It thus seems probable that the dispersal of the Indian forms into the Mediterranean Sea and westward to the North Atlantic and the British Isles must have taken place at a time when some channel other than the Red Sea was open, and the Tethys Sea appears to be the probable solution. A further study of the Indian fauna reveals that several species are now known to be present in the region of the British Isles, but have not so far been taken in the Mediterranean Sea, namely:

Pseudanthessius liber Brady and Robertson.
P. thorelli Brady and Robertson (= *Lichomolgus concinna* Thompson and A. Scott).
Macrochiron (*Macrochiron*) *hirsutipes* (T. Scott).
Artotrogus orbicularis Boeck.
Bomolochus scomberesocis Kröyer.
Monstrilla anglica Lubbock.
M. helgolandica Claus.
Cymbasoma thompsoni Giesbrecht (= *Thaumaleus tropicus* Wolfenden).
Botryllophilus ruber Hesse.

The presence of these species in the Indo-Pacific region and in the north Atlantic area, and their absence in the Mediterranean Sea, indicates either that they have never been able to penetrate into the Mediterranean Sea or its predecessor the Tethys Sea, or else that they originally inhabited the whole area but have at some later date disappeared from the Mediterranean Sea, though they still managed to survive at the east and west

ends of their original area of distribution. One change that took place in the late Cretaceous and early Tertiary epochs was the closure of the channel between North and South America that connected the Atlantic and Pacific Oceans and that between the north-east part of the Indian Peninsula and China, and the effect of this was to cut off the supply of warm tropical water from the Tethys Sea. As Ekman (1935, p. 104) has pointed out, this closure caused the average temperature of the Tethys Sea and the central Atlantic Ocean to drop from some 26° C. to 20° C. This change appears to have affected the Tethys Sea to a somewhat greater degree than the Atlantic Ocean, for whereas the tropical fauna of the Tethys Sea almost completely disappeared, a part of this fauna managed to survive on the west coast of Africa. In the Eocene and Oligocene epochs the Tethys Sea embraced not only the present Mediterranean Sea, but spread over a large part of middle and south-east Europe, North Africa and west Asia and a wide arm ran northwards, connecting the Tethys Sea with the Arctic Ocean. In the upper Miocene the eastern part of this great Tethys Sea became isolated from the Indian and Pacific Oceans on the east and the Mediterranean area on the west and formed the Sarmatian Sea, of which the present-day remains are the Black Sea, the Caspian Sea and the Aral Sea, and these regions became populated by a mixed fauna that was partly fresh-water and partly brackish-water in character. In the Pliocene and early Quaternary epochs the Mediterranean Sea seems to have recovered some, though a relatively insignificant part, of its original tropical fauna, though, in view of the isolation of the eastern region as the Sarmatian Sea, it is difficult to see whence this tropical fauna can have come, unless it came through the Red Sea from the Indian Ocean. Our knowledge of the fauna of the Red Sea and the Suez Canal* is still comparatively meagre and includes the following species:

Cyclopina gracilis Claus.
Euryte longicauda Philippi.
E. robusta Giesbrecht.
Neocyclops salinarum Gurney.
? *Halicyclops æquoreus* Fischer.
**Hersiliodes dubia* Thompson and A. Scott (= *Hemicyclops dubia*).
Asterocheres lilljeborgii Thorell.
A. micheli Gurney.
**Lichomolgus ægyptius* Gurney.
**L. foxi* Gurney.
L. minor A. Scott.
**L. oreastriphilus* (Kossmann) (= *Stellicola o.*).
**L. thorelli* (Kossmann) (= *Stellicola t.*).
**Kelleria purpurocincta* Gurney.
K. regalis Gurney.
Macrochiron (*Paramacrochiron*) *chelifer* Thompson and A. Scott.
**Pseudanthessius mucronatus* Gurney.
**Sabelliphilus leuckarti* Kossmann.
Ergasilus nanus van Beneden.
**Bomolochus parvulus* Nordman.
* *Assecula caligiformis* Gurney.

* Kossmann, 1877; A. Scott, 1902; Thompson and A. Scott, 1903; Schellenberg, 1922; Gurney, 1927.

Entobius loimiæ Dogiel.
**Notodelphys ciliata* Schellenberg.
**N. pachybrachia* Stellenberg.
**N. parva* Stellenberg.
**Paranotodelphys gracilis* Stellenberg.
**Doropygus cylindriformis* Stellenberg.
**D. longimatrix* Stellenberg.
**D. novemsetiferus* Stellenberg.
**Bonnierilla scolaris* Stellenberg.
Bonnierilla sp.
**Notopterophoroides malacodermatus* Schellenberg.
**Pseudonotodelphys phallusiæ* Gurney.
Monstrilla grandis Giesbrecht.
**Cymbasoma gracilis* Gurney.
C. longispinosum Bourne.

With the exception of *Lichomolgus oreastriphilus* (Kossmann), *L. thorelli* (Kossmann) and *Sabelliphilus leuckarti* Kossmann, all recorded from Massowa, the species are from the Gulf of Suez and the Suez Canal. Out of the whole list of 34 species, 21 are known from no other locality and may be regarded as endemic : these I have indicated by an *. Of the remaining 13 species, 4, namely,

Euryte longicauda Philippi,
E. robusta Giesbrecht,
? *Halicyclops æquoreus* Fischer,
Ergasilus nanus van Beneden,

have, as we have already noted, a wide distribution, and may have entered the Suez Canal from either the Mediterranean Sea or the Red Sea : we have already seen that all four species have been taken in the Indian Ocean (*vide supra*, p. 165) and they were all taken in the southern portion of the Suez Canal between Lake Timsah and Port Tewfiq,† which suggests that they reached the Canal from the Indian Ocean. Two species are known from the Gulf of Suez and Suez Canal and the Mediterranean Sea, namely :

Cyclopina gracilis Claus,
Cymbasoma longispinosum Bourne,

and two species have been recorded from this region and from the coasts of the British Isles and Norway, namely,

Asterocheres lilljeborgii Thorell,
Monstrilla grandis Giesbrecht,

and to these we may add *Misophria pallida* Boeck, that was included by Sars in a special Family Misophriidæ in the Harpacticoida, but which Gurney (1927, p. 460) has placed in a special Order, the Misophrioida. Gurney has recorded the presence of a cast skin of this species at Port Tewfiq at the southern end of the Suez Canal.

† In addition to these I may add *Cyclops dengizica* Lepeschkin (= *Cyclops buxtoni* Gurney) that has been recorded by me from the Chilka Lake, India, and by Buxton from the River Tigris at Amara, and is also known from the Black Sea ; but this is not a true marine species.

It would thus appear, so far as the present-day fauna is concerned, that there has been in the past only a relatively slight connection between the Red Sea and the Mediterranean Sea and the coast of Europe on the one hand or between the Red Sea and the Indo-Pacific region on the other.

In a previous paper, dealing with the planktonic Copepoda (Sewell, 1948) I drew attention to the changes that in all probability took place during the last Glacial period in the relationship of the Mediterranean Sea and the Atlantic Ocean on the one hand and the Red Sea and the Indian Ocean on the other. I pointed out that such evidence as we at present possess seems to indicate that in each case there was a complete separation between the two seas and the oceanic area beyond, and that each of these areas became reduced by evaporation to the condition of intra-continental lakes. In the Mediterranean region this reduction appears to have given rise to two lakes separated by a land corridor that ran through Malta, Sicily and Italy. Such a change must have resulted in the extermination of the greater part, if not the whole, of the original marine fauna of both the Mediterranean Sea and the Red Sea, and only later, at the close of the Glacial period, by the reopening of their oceanic connections could a marine fauna have been reintroduced into the Mediterranean Sea from the Atlantic and the Red Sea from the Indian Ocean respectively.

If we accept this view that the Mediterranean Sea and Red Sea were completely cut off from the oceans during the last Glacial period, and only later came to be repopulated by marine organisms, this would well account for the presence of both Mediterranean and Indo-Pacific species in the Suez Canal zone, but not for the presence in this area of species that are so far known from the Canal zone and the coasts of Europe and Norway, but are not known from the Mediterranean Sea or the Indian Ocean ; but further researches may reveal their presence in one or both of these regions.

Our knowledge of the fauna of the Mediterranean Sea is probably far from complete, in spite of the work of Kerschner (1870), Gourret (1889), Giesbrecht (1890, 1900), Pesta (1908), Brément (1909), Chatton (1909), Chatton and Brément (1909, 1910 and 1911), Grandori (1926) and Brian (1928) ; and such information as we possess comes in the main from the western end, and particularly from the region round Naples and Monaco. I have been able to collate references to the following species :

CYCLOPOIDA.

Cyclopina bisetosa Grandori.
**C. elegans* T. Scott.
C. ensifera Grandori.
C. esilis Brian.
**C. gracilis* Claus.
**C. littoralis* Boeck.
**C. longicornis* Boeck.
C. schneideri T. Scott (? = *C. brevifurca* Sars).
? *C. tumidula* Sars.
**Pterinopsyllus egregius* Giesbrecht.
P. illustris Giesbrecht.
P. insignis Brady.

**Euryte longicauda* Philippi.
E. longiseta Grandori.
E. robusta Giesbrecht.
? **Halicyclops æquoreus* Fischer (? = *H. christianensis* Boeck).
**Asterocheres bœcki* (Brady).
A. dentatus Giesbrecht.
**A. echinicola* (Norman).
**A. latus* (Brady).
A. minutus Claus.
**A. parvum* Giesbrecht.
**A. stimulans* Giesbrecht.
**A. suberitis* Giesbrecht.
A. ventricosum Brian.
**Echinocheres violaceus* Claus.
**Dermatomyzon elegans* Claus.
**D. nigripes* (Brady).
Rhynchomyzon falco Giesbrecht.
**R. purpurocinctum* (T. Scott).
Collocheres canui Giesbrecht.
**C. gracillicauda* (Brady).
**Scottocheres elongatus* (T. Scott).
S. longifurca Giesbrecht.
**Ratania flava* Giesbrecht.
Ratania sp. Rose.
Pontœciella abyssicola (T. Scott).
**Acontiophorus ornatus* Brady.
**A. scutatus* Brady and Robertson.
Myzopontius pungens Giesbrecht.
Sestropontius bullifer Giesbrecht.
Dyspontius fringilla (Giesbrecht).
D. passer (Giesbrecht).
**D. striatus* Thorell.
Cryptopontius brevifurcatus Giesbrecht.
C. capitis Giesbrecht.
C. tenuis (Giesbrecht).
C. thorelli (Giesbrecht).
**Bradypontius canui* Giesbrecht (= *B. magniceps* Brady).
B. chelifer Giesbrecht.
**B. papillatus* (T. Scott).
B. siphonatus Giesbrecht.
**Artotrogus orbicularis* Boeck.
**Parartotrogus richardi* T. and A. Scott.
**Cancerilla tubulata* Dalyell.
Pteropontius cristatus Giesbrecht.
Dystrogus gladiator Giesbrecht.
**Lichomolgus agilis* (Leydig).

**L. albens* Thorell.
L. elongatus Buchholz.
**L. forficula* Thorell.
**L. furcillatus* Thorell.
L. longicauda (Claus).
L. vagans Gurney.
L. mytilis Raffaele and Monticelli.
Pseudolichomolgus pectinis Pesta.
**Pseudanthessius gracilis* Claus.
**Modiolicola insignis* Aurivillius.
Lichomolgidium sardum Kossmann.
**Anthessius arenicolus* (Brady) (= *Pseudomolgus a.* Brady).
A. pleurobranchiæ Della Valle.
**A. solenocourti* Della Valle.
A. spinosus Raffaele and Monticelli.
**Sabelliphilus elongatus* M. Sars (= *S. sarsi* Claparède).
Ergasilus lagunaris Grandori.
**E. nanus* van Beneden.
**Eunicicola clausi* (Kurz).
Lacanurius intestinalis Kossmann.
**Mytilicola intestinalis* Steuer.
**Bomolochus belonis* Burmeister.
B. muræna Brian.
**B. soleæ* Claus.
**B. unicirrus* Richiardi.
Anchistrotos gobii Brian.

NOTODELPHYOIDA.

**Notodelphys allmani* (Thorell).
N. elegans Thorell.
N. prasina Thorell (= *pusilla* Buchholz).
N. rufescens Thorell.
N. tenera Thorell.
**Doropygus normani* Brady.
**D. psyllus* Thorell.
**D. pulex* Thorell.
**Pachypygus gibber* (Thorell).
**Ascidicola rosea* Thorell.
**Notopterophorus elongatus* Giesbrecht.
N. elongatus var. *massiliensis* Gourret.
**N. gibber* Thorell.
**N. papilio* Hesse (var. *massiliensis* Gourret).
N. papillatus Hesse.
**Bonnierilla longipes* Kerschner.
**Gunentophorus globularis* Costa.

Botryllophilus banyulensis Brément.
B. brevipes Brément.
B. notopus Della Valle.
Botachus cylindratus Thorell.
B. fusiformis Buchholz.
**Enterocola bettencourti* Canu.
**E. fulgens* van Beneden.
E. pterophora Chatton and Brément.
Enterognatha comatulæ Giesbrecht.
Aplostoma banyulensis Brément.
A. sacculus Chatton and Brément.
A. sycozoæ salpi
**Mycophilus curvatus* Chatton and Brément.
Ophioseides abdominalis Chatton and Brément.
O. joubini Chatton.
Brementia balneolensis Chatton and Brément.
Ooneides amela Chatton and Brément.
**Doroixys uncinata* Kerschner.
Gonodelphys trigonus Buchholz.
Paryphes longipes Kerschner.
Hersilia (*Clausidium*) *apodiforme* Philippi.

MONSTRILLOIDA.

**Monstrilla gracillicauda* Giesbrecht.
**M. longicornis* Thompson.
**Cymbasoma longispinosum* Bourne.
**C. rigidum* Thompson.
**C. thompsoni* (Giesbrecht) (= *Thaumaleus tropicus* Wolfenden).

Out of the total number of 126 species in the above list as many as 63, or 50 per cent., are known to occur on the Atlantic coast of France or on the coasts of the British Isles and the English Channel: I have indicated these species by an *. It is thus clear that there is a far closer degree of relationship between the faunas of the Mediterranean Sea and the North Atlantic Ocean, as it exists at the present time, especially round the British Isles, than between the Mediterranean Sea and the regions lying further east. Reference to the Chart of the coastal shelves (Chart I) shows that there is complete continuity from the area round the British Isles southwards down the European coast and past the entrance to the Strait of Gibraltar to the west coast of Africa; species can therefore make their way along the coast to the entrance to the Mediterranean Sea, though, owing to the main trend of the North Atlantic Drift, passage southwards from the British Isles to the coast of Spain and Portugal will not be easy, since it will entail a migration against the current; but from the coasts of France and Spain in the Bay of Biscay migration southward will be assisted by the prevailing Canary current. Having reached the region of the Strait of Gibraltar species can, both in the past and at the present time, have been swept into the Mediterranean. At the close of the last Glacial period this influx of water must have been of considerable strength and volume, and even at the present day there

is a continuous flow of water into the Mediterranean Sea that will tend to carry more immigrants into this land-locked basin.

A number of the above species have been recorded from the Atlantic coast of France, namely :

Euryte longicauda Philippi.
Acontiophorus scutatus Brady and Robertson.
Dyspontius striatus Thorell.
Cancerilla tubulata Dalyell.
Lichomolgus agilis Leydig.
L. poucheti Canu.
Sabelliphilus elongatus M. Sars (= *S. sarsi* Clap.).
Doropygus pulex Thorell.
Notodelphys agilis Thorell.
N. allmani Thorell.
Ascidicola rosea Thorell.
Enterocola bettencourti Canu.
Enteropsis pilosus Canu.
Pontœciella abyssicola (T. Scott).
Ratania atlantica Farran.
Doroixys uncinata Kerschner.

Of these 16 species as many as 11, or 69 per cent., have been taken in the Mediterranean Sea. As we pass further south along the west coast of Africa to the Gulf of Guinea the percentage of British species appears to decrease ; but our knowledge of the fauna of the Gulf of Guinea is derived solely from T. Scott's Report (1894), in which he lists only six species belonging to the groups under consideration, namely :

Asterocheres latus (Brady) (as ? *Cyclopicera lata* Brady).*
Lichomolgus congoensis T. Scott.
Pseudanthessius propinquus T. Scott.
Pontœciella abyssicola (T. Scott) (as *Artotrogua a.*).
Hersiliodes livingstoni (T. Scott) (as *Hemicyclops l.*).
" *Saphirella abyssicola* " T. Scott.

Of these only a single species, *Asterocheres latus* (Brady), is known to be present on the coasts of the British Isles, and a second species, *Pontœciella abyssicola* (T. Scott) has been taken in the Bay of Biscay along with *Ratania atlantica* Farran. Farran only had examples of the female sex of this latter species : Rose (1939) has recorded the presence in the Bay of Algiers of two species of *Ratania*, one of which is *R. flava* Giesbrecht, and it is possible that the second species is *R. atlantica* Farran.

In addition to those species that are known to be present on and around the coasts of Britain and France, there are six other species in the Mediterranean Sea that have been recorded from the coasts of Norway, though they have not, as yet, been taken round the British Isles. These species are as follows :

Cyclopina schneideri T. Scott (? = *C. brevifurca* Sars).
C. tumidula Sars.

* T. Scott (1894, p. 127) appears to have considered that Brady's species *latus* was a synonym of Norman's *echinicola*, but Sars (1913–18, p. 91) does not agree with this view.

Euryte robusta Giesbrecht.
Rhynchomyzon falco Giesbrecht.
Myzopontius pungens Giesbrecht.
Cryptopontius brevifurcatus Giesbrecht.

During the Tertiary era there was a direct connection between the Tethys Sea and the Arctic Ocean, and it is possible that some of the above species may, perhaps, be part of a relict fauna that was left in the Tethys Sea, when this northern connection became obliterated, but in view of the changes that took place during the last Glacial Period this seems highly unlikely. The species that this explanation might particularly apply to are *Myzopontius pungens* Giesbrecht and *Cyclopina steueri* T. Scott, both of which have been recorded from the Arctic Ocean; but I think that it is more probable that they all gained entry to the Mediterranean Sea at a more recent period. As Ekman (1935, p. 131) has pointed out, during the Glacial and Quaternary periods a number of Arctic species made their way into the Mediterranean Sea. This process was doubtless assisted by the cooling of the surface water of the North Atlantic that took place at that time. The work of Bradley, Bramlette, Cushman *et al.* (1938) has shown that the stratification of the bottom deposits in the North Atlantic Ocean reveals the changes that occurred in the planktonic fauna during the Glacial period, warm-water species of Foraminifera being replaced during several periods by cold-water forms. Such a cooling of the surface water would have rendered it possible for northern and boreal species of Copepoda to exist much further to the south than they do to-day, and thus, when the sea-level finally rose and the water of the North Atlantic poured through the re-opened Strait of Gibraltar, these northern species may have been carried in and have been able to survive, though they have since apparently disappeared from the region of the British Isles. O'Donoghue (1929) has put forward the same explanation to account for the resemblance at the present day of the Opisthobranchiate Molluscs of the Mediterranean and the North Pacific area: he remarks: "The resemblance between the Mediterranean fauna and that of the Pacific coast of North America is sufficient to require notice. It apparently implies the existence, at some time or other during the history of some of the present species, of a circumpolar Sea or at least a free water-way between the Atlantic and Pacific Oceans to the north. Granted this, then the descent of the ice-caps from the Pole during the Glacial periods would drive the northern forms to the south, or, at any rate, permit of their much more southern migration. In this way probably the Mediterranean, then colder than at present, received a supply of the characteristic cold-water forms. . . . The subsequent retreat of the Ice-cap would leave such forms as relicts in the Mediterranean."

In the open waters of the North Atlantic a few species have been taken in the tow-net; these are—

Macrochiron fucicolum (Brady),
M. sargassi Sars,
Pseudanthessius fucicolus T. Scott,
Anthessius leptostylis (Sars),

all of which seem to be inhabitants of floating weed masses, and

Urocopia singularis Sars,
Hyalopontius typicus Sars,

which appear to be deep water forms and are free swimming. Of these, two species are

known from the coasts of the British Isles, namely, *Macrochiron fucicolum* and *Anthessius leptostylis*, and *Macrochiron sargassi* has been recorded from the Pacific (*vide supra*, p. 161) but the remaining three species are not known from any other locality.

We now come to the consideration of the fauna of the great northern shelf that includes the region of the north-west coast of Europe and the British Isles, the coast of Norway and the islands of Spitzbergen, Nova Zembla and Franz Josef Land, that enclose the Barents Sea. This region is one of the best known areas, so far as the Copepoda are concerned.

The species that up to the present time have been recorded from the British Isles, North Sea and the English Channel† are as follows:

CYCLOPOIDA.

**Cyclopina elegans* T. Scott.
**C. gracilis* Claus.
C. kieferi Schafer.
C. latipes Schafer.
**C. littoralis* Brady.
**C. longicornis* Boeck.
C. longifurcata T. Scott.
**C. norvegica* Boeck.
**Pterinopsyllus insignis* Brady and Robertson.
**Euryte longicauda* Philippi.
**E. minor* T. Scott.
**Halicyclops æquoreus* Fischer (= *H. christianensis* Boeck).
**Asterocheres bœcki* (Brady).
A. canui Giesbrecht.
**A. echinicola* (Norman).
A. kervillei Canu.
**A. latus* (Brady).
**A. lilljeborgii* Boeck.
**A. parvum* Giesbrecht.
A. renaudi Canu.
**A. simulans* T. Scott.
A. stimulans Giesbrecht.
A. suberitis Giesbrecht.
**Echinocheres violaceus* Claus.
**Dermatomyzon nigripes* (Brady and Robertson).
**Rhynchomyzon purpurocinctum* (T. Scott).
**Collocheres gracillicauda* Brady.
**Mesocheres anglicus* Norman and T. Scott.
**Leptomyzon elegans* (A. Scott).

† Baird (1850); Brady (1872, 1880 and 1906); Brady and Robertson (1873); Canu (1888, 1891, 1892 and 1894); Claus (1863); Farran (1913); Gurney (1933); Hesse (1864); Lubbock (1875); Monod (1928); Monod and Dollfuss (1932); Norman and Brady (1909); Norman and T. Scott (1906); Pearson (1905); Pesta (1928 and 1932); Sars (1913–18 and 1921); Schafer (1936); T. Scott (1892*a*, 1892*b*, 1892*c*, 1893*a*, 1893*b*, 1897, 1899, 1900, 1901*a*, 1901*b*, 1903, 1904, and 1905); T. and A. Scott (1892); Smirnov (1931); Thompson (1883 and 1892); Timm (1894).

**Scottocheres elongatus* (T. and A. Scott).
**Scottomyzon gibberum* T. Scott.
**Neopontius angularis* T. Scott.
**Acontiophorus ornatus* Brady.
**A. scutatus* (Brady and Robertson).
Dyspontius curticaudatus T. Scott.
**D. striatus* Thorell.
**Bradypontius magniceps* Brady.
**B. papillatus* T. Scott.
**Cribropontius normani* Brady and Robertson.
**Artotrogus orbicularis* Boeck.
Parartotrogus richardi T. and A. Scott.
**Cancerilla tubulata* Dalyell.
Microcancerilla cæruleocruciata Norman and Brady.
Hemicyclops aberdonensis T. Scott.
**H. purpureus* Boeck (= *Lichomolgus littoralis* T. Scott).
**Lichomolgus agilis* Leydig.
**L. albens* Thorell.
**L. canui* Sars.
**L. forficulus* Thorell.
**L. furcillatus* Thorell.
**L. poucheti* Canu.
L. trochi.
**Macrochiron* (*Macrochiron*) *fucicolum* Brady.
**M.* (*M.*) *hirsutipes* T. Scott.
**Pseudanthessius gracilis* Claus.
**P. liber* Brady and Robertson.
**P. sauvagei* Sars.
P. thorelli Brady and Robertson.
Modiolicola inermis Canu.
**M. insignis* Aurivillius.
Herrmannella maxima (Thompson).
**H. parva* Norman and T. Scott.
H. rostrata (Canu) (*Paranthessius r.* Canu).
**Anthessius arenicola* (Brady and Robertson).
**A. leptostylis* (Sars) (*Pseudomolgus l.* Sars).
A. solenocourti Della Valle.
**Sabelliphilus elongatus* M. Sars.
Hersiliodes littoralis (T. Scott).
H. pelseneeri Canu.
H. thompsoni Canu.
Giardella callianassæ Canu.
Nicothoë astaci Aud. and M.-Edwards.
Cholidya polypi Farran.†

† Farran (1914) placed this genus and species in the Harpacticoida near *Idya*, but Monod and Dollfuss (1932) have transferred it to the Cyclopoida, family Lichomolgidæ.

Trochicola entericola Dollfuss.
Cancerina confusa T. Scott.
Clausia cluthæ T. and A. Scott.
Ergasilus nanus van Beneden.
**E. sieboldi* Nordmann (= *E. gibbus*, *E. surbecki* and *E. trisetaceus*).
Thursetina gasterostei (Pagenstecher).
**Eunicicola clausi* Kurz.
Mytilicola intestinalis Steuer.
Bomolochus belones Burmeister.
B. onosi T. Scott.
B. scomberesocis Kröyer.
B. soleæ Claus.
B. unicirrus Richiardi.
B. zeugopteri T. Scott.

NOTODELPHYOIDA.

**Notodelphys agilis* Thorell.
N. allmani Thorell.
**N. cærulea* Thorell.
**N. elegans* Thorell.
**N. prasina* Thorell.
**Agnathaner typicus* Canu.
A. minutus Canu.
Doropygus ? gibbosa Thorell.
**D. porcicauda* Brady.
**D. psyllus* Thorell.
**D. pulex* Thorell.
**Pachypygus gibber* (Thorell).
**Notopterophorus auritus* (Thorell).
N. elongatus Buchholz.
**N. papilio* Hesse.
**Gunentophorus globularis* Costa.
**Botachus cylindratus* Thorell.
Doroixys uncinata Kerschner.
Bonnierilla longipes Kerschner.
**Ascidicola rosea* Thorell.
Botryllophilus aspinosus Schellenberg.
B. macropus Canu.
B. ruber Hesse.
**Cryptopodus brevicauda* (Canu) (= *Aplostoma b.* Canu).
**C. eruca* Norman.
Aplostoma beaumonti T. and A. Scott.
A. hibernica T. and A. Scott.
Enterocola betencourti Canu.
E. fulgens van Beneden.
Enteropsis pilosus Canu.

E. roscoffensis Chatton and Brément.
Platypsyllus minor T. Scott.
Nereicola concinna T. Scott.
Mycophilus curvatus Chatton and Brément.
M. pachygaster Hesse.
**M. roseus* Hesse.
M. vararensis T. Scott (? = *M. roseus* Hesse).

MONSTRILLOIDA.

Monstrilla anglica Lubbock.
**M. gracillicauda* Giesbrecht.
M. grandis Giesbrecht.
**M. helgolandica* Claus.
**M. longicornis* Thompson.
**Monstrillopsis dubia* (T. Scott).
**Cymbasoma germanicus* (Timm).
**C. longispinosus* (Bourne).
**C. rigidum* Thompson.
C. rostratus T. Scott.
? **C. thompsoni* (Giesbrecht).
C. zetlandicus T. Scott.
Hæmocera danæ Clap., Malaquin.
H. filogranarum Malaquin.
H. roscovita Malaquin.

Of the 139 species recorded in the above list, as many as 76, indicated by *, have been taken on the coasts of Norway; thus the percentage of British species that are known from Norway is as high as 55. T. Scott (1903*b*, p. 6) has called attention to the fact that from time to time "besides the occasional introduction of southern species within our (British) faunal limits by oceanic currents, other forms whose natural habitat is arctic or sub-arctic make their appearance at intervals but sometimes in abundance. These are usually found early in the year, and are probably brought to our shores by a more than usual southward trend of cold water from the North Atlantic." Scott was referring especially to planktonic forms, such as the boreal or arctic species *Halithalestris krohni* (Kröyer), which has been recorded from various parts of the Arctic sea, off the coast of Finmark, Novaya Zembla, Spitzbergen, etc. It is thus possible that certain species found on both the British and Norwegian coasts may have originated in Norway and have invaded the British coastal region subsequently.

Reference to the Chart shows that there is no barrier to the migration of species from the region of the British Isles to the coast of Norway for, although there is a deep-water gulf running southwards down the Norwegian coast, the depth of this is less than 2000 m. Moreover, reference to the general trend of the surface currents in this region shows that the North Atlantic Drift, after passing around the north coast of Scotland, divides into two main branches, one of which turns southwards down the east coast of Scotland and then sweeps round the North Sea to reach the Norwegian coast. T. Scott (1906) has given a list of species that are known from the Firth of Forth on the east coast

of Scotland : these number 55 in all, and no less than 41 have been recorded from the Norwegian coast, so that the percentage is as high as 76. It thus seems probable that this current assists the passage of species from the one region to the other : as it sweeps along many species will be carried past Heligoland towards the entrance to the Baltic Sea. Timm (1894) and Schafer (1936) have recorded 11 species from the Heligoland coast, namely :

Cyclopina brachystylis Sars,
**C. elegans* T. Scott,
**C. gracilis* Claus,
**C. kieferi* Schafer,
**C. latipes* Schafer,
**C. littoralis* (Brady).
**Notodelphys agilis* Thorell.
**Ascidicola rosea* Thorell.
**Monstrilla grandis* Giesbrecht.
**M. helgolandica* Claus,
**Cymbasoma rigidum* Thompson,

and of these as many as 10, marked with *, or 91 per cent., are known from the Scottish coast or the British Isles.

Giesbrecht (1882) and Kunz (1936) have recorded a number of species from Kiel Bay in the Baltic Sea, and Thorell (1859) and Olsen (1869) have also given lists of species that have been taken off Bohusland in the Kattegat. The list of species that occur in the Baltic Sea is as follows :

Cyclopina gracilis Claus,
Asterocheres lilljeborgii Boeck (= *Ascomyzon asterocheres* Sars),
A. parvus Giesbrecht,
A. siphonatus Giesbrecht (= *Ascomyzon lilljeborgi* Thorell),
Lichomolgus agilis Leydig,
L. albens Thorell,
L. canui Sars,
L. forficulus Thorell,
L. furcillatus Thorell,
L. marginatus Thorell,
Dermatomyzon nigripes Brady,
Scottocheres elongatus T. Scott,
Bradypontius papillatus T. Scott,
Dyspontius striatus Thorell,
Artotrogus orbicularis Boeck,
Thersetina gasterostei (Pagenstecher),
Notodelphys agilis Thorell,
N. allmani Thorell,
N. cærulea Thorell,
N. elegans Thorell,
N. prasina Thorell,
N. rufescens Thorell,

N. tenera Thorell,
Doropygus psyllus Thorell,
D. pulex Thorell,
Doropygopsis longicauda (Aurivillius),
Doropygella thorelli (Aurivillius),
Notopterophorus auritus (Thorell),
Gunentophorus globularis Costa,
Pachypygus gibber Thorell,
Botachus cylindratus Thorell,
Buprorus loveni Thorell,
Cymbasoma rigidum Thompson,
C. thompsoni (Giesbrecht),

and to these may be added *Halicyclops magniceps* (Lilljeborg) (= *H. christianensis* Boeck). Of these 34 species as many as 26 are known from the British Isles, or 76 per cent.

A number of species appear to have had their origin on or around the Norwegian coastal area and in the Skagerrak, and up to the present time none have been taken in any locality to the west or south-west of this region with the single exception of *Cyclopina brachystylis* Sars, which is known from Heligoland. These species are :

Cyclopina brachystylis Sars.
C. euacantha Sars.
C. dilatata Sars.
C. pygmæa Sars.
Cyclopetta difficile Sars.
Euryte curticornis Sars.
Rhynchomyzon rubrovittatum Sars.
Arctopontius expansus Sars.
Bradypontius major Sars.
B. caudatus Sars.
Hippomolgus furcifer Sars.
Lichomolgus marginatus Thorell.
L. tenuifurcatus Sars.
Pseudanthessius assimilis Sars.
P. dubius Sars.
Lichomolgella pusilla Sars.
Herrmannella dubia Sars.
H. prehensilis Sars.
H. tenuicordis Sars.
H. valida Sars.
Anthessius dilatatus (Sars) (= *Pseudomolgus d.* Sars).
Rhinomolgus anomalus Sars.
Conchocheres malleolatus Sars.
Notopterophorus micropterus Sars.
Pteropygus vestitus Sars.
Enterocola bilamellata Sars.
Buprorus lovéni Thorell.

B. nordgaardi Sars.
B. pranizoides Sars (= *Anomopsyllus pranizoides* Sars).
Thespesiopsyllus paradoxus (Sars.)
Monstrilla clavata Sars.
M. leucopis Sars.
M. intermedia Aurivillius.

In addition to these 33 species, 2 others, namely *Botryllophilus brevipes* Sars and *Monstrilla serricornis* Sars, have been recorded from the coast of Norway and the Woods Hole region of the east coast of North America, but at present we have no indication whether these have managed to migrate from America to Norway, in which case we may hope that they will ultimately be found among the British fauna, or have passed westwards from the Arctic or boreal region and then down the American coast.

As we pass still further northwards into the Arctic regions to the extreme north of Norway and to the islands Novaya Zembla, Franz Josef Land and Spitzbergen, surrounding the Barents Sea and the Kara Sea, the number of species that have been recorded falls to a relatively small figure :

Cyclopina barentsiana Smirnov.
C. gracilis Claus.
C. norvegica Boeck.
C. schneideri T. Scott.
Euryte longicauda Philippi.
Asterocheres boecki Brady.
Dermatomyzon nigripes Brady.
Myzopontius pungens Giesbrecht.
Artotrogus orbicularis Boeck.
Parartotrogus arcticus T. Scott.
Macrochiron (*Macrochiron*) *hirsutipes* T. Scott.
Anthessius leptostylis (Sars) (= *Pseudomolgus l.* Sars).
Schizoproctus inflatus Aurivillius.
Doropygus pulex Thorell.
Doropygopsis longicauda Aurivillius.
Buprorus lovéni Thorell.
Selioides bolbroei Levinsen.
Enteropsis dubius Schimkewitsch.

Of these 17 species, 5 are of very wide distribution, and have been recorded from the Indian Ocean as well as from the North Atlantic : these are *Euryte longicauda* Philippi, *Dermatomyzon nigripes* Brady, *Artotrogus orbicularis* Boeck, *Macrochiron* (*Macrochiron*) *hirsutipes* T. Scott and *Doropygus pulex* Thorell. Three have been recorded from the coasts of the British Isles and Norway, namely, *Cyclopina gracilis* Claus, *C. norvegica* Boeck and *Artotrogus orbicularis* Boeck, while 7 others are known from the coast of Norway, namely :

Cyclopina schneideri T. Scott.
Myzopontius pungens Giesbrecht.
Parartrotrogus arcticus T. Scott.
Anthessius leptostylis Sars.

Schizoproctus inflatus Aurivillius.
Doropygopsis longicauda Aurivillius.
Buprorus lovéni Thorell.

Two species, namely *Cyclopina barentsiana* Smirnov and *Selioides bolbroei* Levinsen, appear to be true arctic forms.

As we pass westwards from the British Isles to the Faroes, Iceland and Greenland, we still find a number of species that are known from both regions. From the Faroe Islands and the coast of Iceland the following 12 species have been recorded :

Cyclopina phallusiæ Hansen.
Asterocheres boecki Brady.
Scottocheres gracilis Hansen.
Metapontius latispinis Hansen.
Dermatomyzon nigripes Brady.
Acontiophorus scutatus (Brady and Robertson).
Eunicicola clausi Kurz.
Thersitina gasterostei (Pagenstecher).
Notodelphys rufescens Thorell.
Doropygella thorelli (Aurivillius).
Doropygopsis longicauda (Aurivillius).
Buprorus lovéni Thorell.

Of these the three species described by Hansen (1923) are unknown, so far, from any other locality ; but the remaining 9 are all known from localities to the east, one from the British Isles, four from the British Isles and Norway, and four others from Norway but not, as yet, from the British Isles.

Passing still further westward to the coast of Greenland we have records of 25 species belonging to the groups under review, namely :

**Cyclopina gracilis* Claus.
**C. littoralis* Brady.
**C. longicornis* Boeck.
**Euryte longicauda* Philippi.
Asterocheres abyssi (Hansen).
A. intermedium (Hansen).
**A. lilljeborgii* Thorell (= *A. siphonatus* Giesbrecht).
A. tenerum (Hansen).
**Dermatomyzon nigripes* Brady.
Acontiophorus antennatus Hansen.
**A. ornatus* Brady.
**Arctopontius expansus* Sars.
Bradypontius dentatus Hansen.
B. grœnlandicus Hansen.
**B. magniceps* Brady.
B. tenuipes Hansen.
B. unidens Hansen.
**Parartotrogus arcticus* Sars.
Anthessius grœnlandicus (Hansen) (= *Pseudomolgus g.*).

Botryllophilus inæquipes Hansen.
**Schizoproctus inflatus* Aurivillius.
Enterocola setifera Hansen.
Selioides bolbrioe Levinsen.
Blakeanus grœnlandicus Hansen.
Monstrilla wandeli Stephensen.

Of these 25 species, 11, marked with *, are known from the coasts of the British Isles or Norway, or both.

Reference to the Chart shows that there is a direct connection between the Eur-Asian coastal shelf on the east and the Greenland-American shelf on the west, formed by the Faröe-Iceland Bank between the British Isles and Iceland and the Iceland-Greenland Bank between Iceland and the shelf surrounding Greenland and North America, and over these two ridges the depth of water is everywhere less than 2000 m., so that there should be no bar to the passage of species from one area to the other. Four other species from this region have been previously recorded from the Barents Sea area, namely :

Arctopontius expansus Sars.
Parartotrogus arcticus Sars.
Schizoproctus inflatus Aurivillius.
Selioides bolbroei Levinsen.

These latter may have made their way westward from the Barents Sea to the Greenland-American region, or they may have originated in the Greenland area and have migrated westward across the Bering Strait to the Asiatic coast and so to the Barents Sea. Though we, as yet, know but little regarding the full extent of the distribution of those species that are truly arctic, it is probable that many of them have a circumpolar range : *Cyclopina schneideri* T. Scott has been recorded from the northern coast of Norway and the Barents Sea on the one hand and from Dolphin and Union Strait on the north coast of Canada, a range from lat. 30° E. to 110° W. ; but other species, as, for instance, *Cymbasoma bernardensis* (Willey), also from Union Strait, may be endemic. Among the epi-planktonic Calanoida, I have shown (Sewell, 1948) that certain species appear to have been carried southward from the Arctic region by the Labrador Current through Davis Strait to the east coast of North America, but among the present groups the only species that, so far, is known to be common to the Arctic Ocean and the East coast of North America is *Doropygus pulex* Thorell, which has a world-wide distribution. I have already mentioned that this species and three others, namely *Doropygopsis longicauda* (Aurivillius), *Cancerilla tubulata* Dalyell and, perhaps, *Macrochiron sargassi* Sars, may have been carried from the Arctic region through the Bering Strait into the North Pacific Ocean, and possibly *Cyclopina brachystylis* Sars has suffered the same fate, for this species has now been recorded from the coast of Norway, and more recently by Smirnov (1935) from the region of Vladivostok in the north-west Pacific area, but Schafer (1936) has cast doubt on Smirnov's identification.

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Map of the World, showing the distribution of depths

of 0–2000 m. (yellow) and 2000–3000 m. (green).